To Audiences

Toshiba Motor Control & Driver Introduction

东芝电机控制驱动IC介绍
——MCD纯硬件方式——

TOSHIBA

Toshiba Devices & Storage (Shanghai) Co., Ltd.

2020.06.19

东芝电机控制的战略方针

为电机控制应用提供全面解决方案

直流电机驱动

- **有刷电机** — 低成本
- **步进电机** — 高精度
- **直流无刷电机** — 低噪音，低振动

车辆

大型电机
EV／HEV主电机
EPS

中型电机
风机电机
冷却风扇
电动门

小型电机
油泵
燃油泵
水泵
电子节气门
镜子

TM-SIL™（计划中）
功能安全支持封装

工业

步进电机


播放设备


缝纫机


监控摄像头


ATM

有刷直流电机

广泛的阵容
当前规格&封装：190件


自动售货机


办公自动化设备


清洁机器人

东芝电机控制器技术的优势

- 基于40年的市场经验的系统提案
- 依托于全东芝集团的电力电子技术

家用电器


压缩机

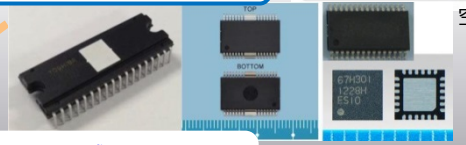
压缩机电机

Cortex®-M4 160MHz
内置电机控制保护电路
内置矢量控制协处理器
内置模拟电路
内置高端AD转换器

TX00／03／04／TXZ系列
（内置矢量引擎）

正弦波无传感器微控制器

风扇电机



3相无刷&无传感器
从小容量至大容量的各种阵容

控制器／驱动器


空调


冰箱


单相／3相轴流风机

分立器件& IPD

功率器件

东芝技术的实践

拥有10个销售卖点的领先领域

Intelligent Phase Control 智能相位控制
Closed Loop： 闭环控制
AGC：Active Gain Control 主动增益控制
ACDS：Advanced Current Detection System 高级电流检测系统
ADMD： Advanced Dynamic Mixed Decay 高级动态混合衰减

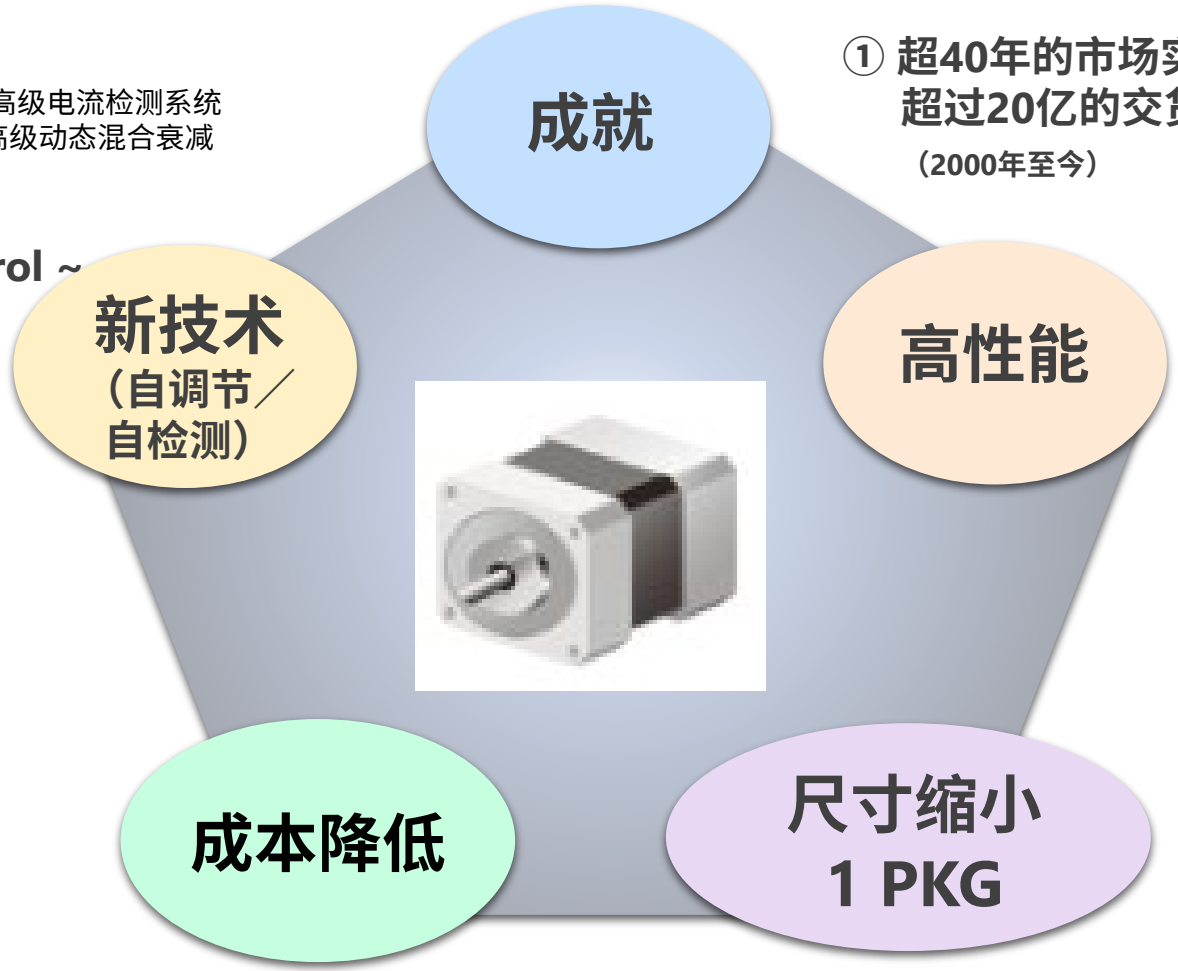
③ 先进的自动调节系统
~ Intelligent Phase Control ~

④ 速度控制信号 –更少
~ Closed Loop ~

⑤ 自动电流优化
~ AGC ~

⑥ 高级动态混合衰减
~ADMD~

⑦ 节省BOM成本
~ ACDS ~



① 超40年的市场实绩
超过20亿的交货件
（2000年至今）

② 率先采用 0.13um 新制程工艺
（更低的功耗）

⑧ 低功耗技术
（低泄漏电流）

⑨ 高品质、高可靠性

⑩ 先进的融合技术
（SiP／PMMCD）

① 拥有各种市场和应用的领先记录

超40年的市场实绩


Automotive


Multi Function Printer


Page Printer


Ink Jet Printer


ATM

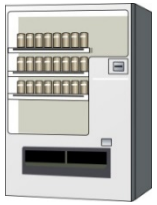

Thermal Printer

Over 300 customers worldwide are using our MCDs.


Surveillance camera


Digital Camera

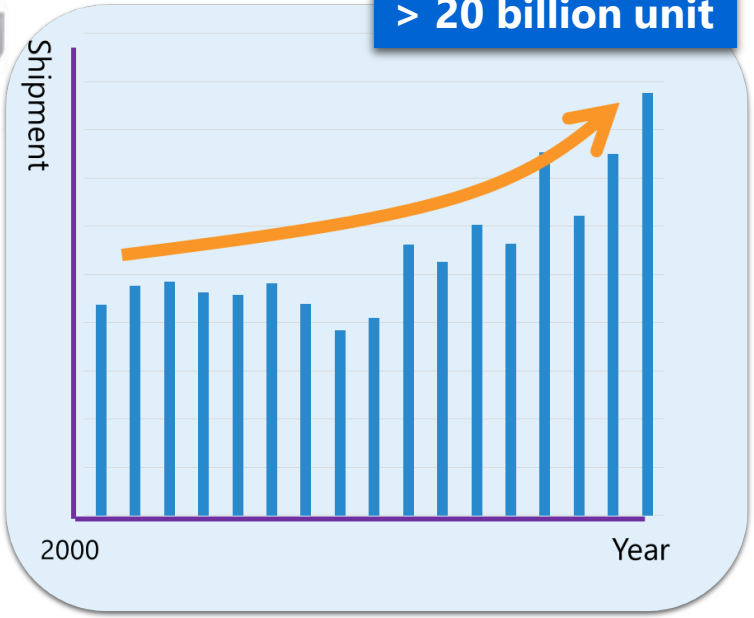

Amusement machine


Vending Machine


Generator


POS terminal

Total Shipment: > 20 billion unit




Chip Mounter


Textile machine


Optometry Machine


Lenz Grinder

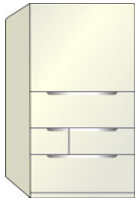

Syringe


Dialyzer


Bidet


A/C fan


Drum type W/M

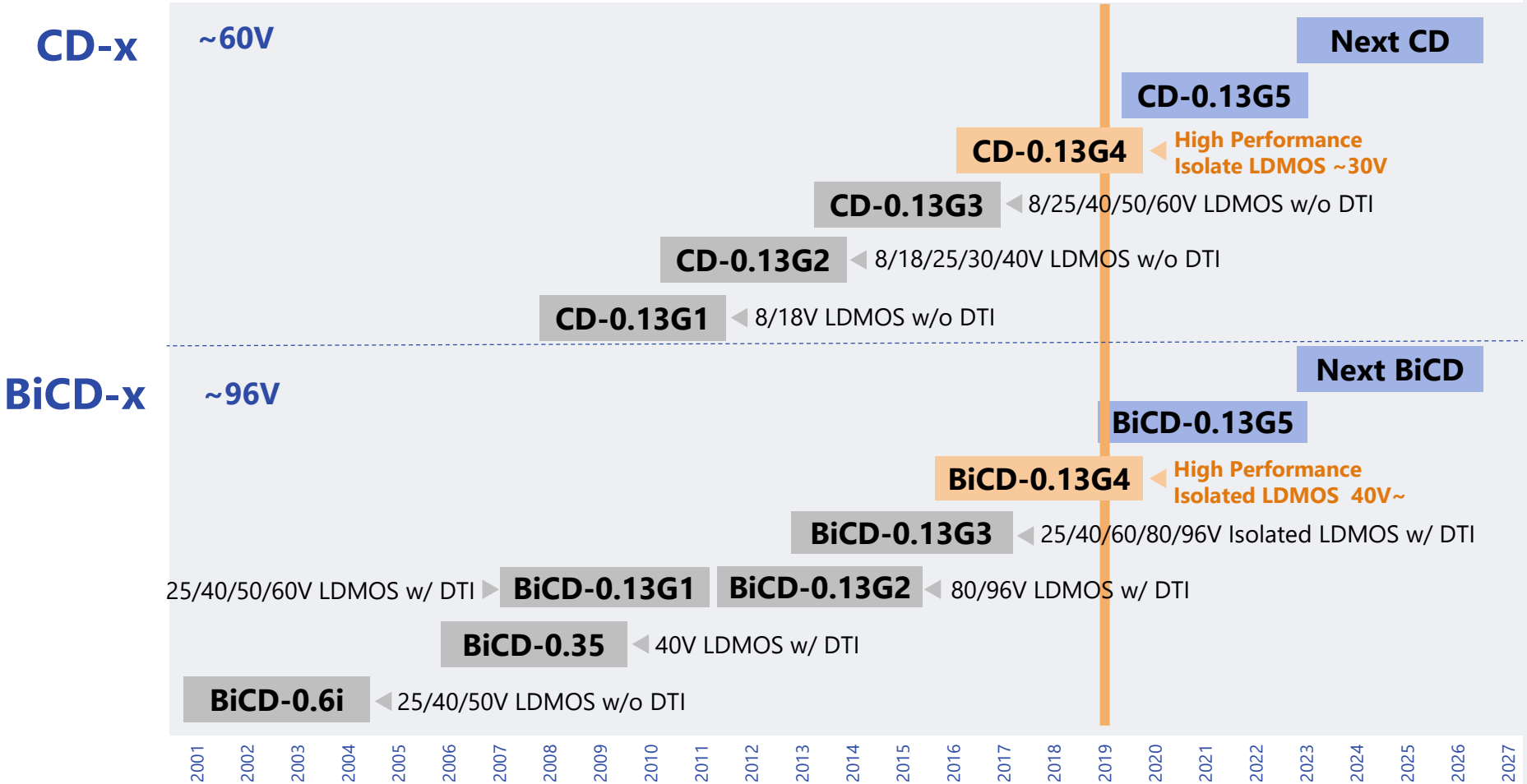

R/F


Cooling Fan


Robotic cleaner

② 采用 0.13um新工艺实现更低功耗

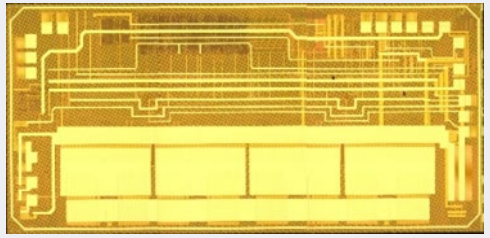
实现大电流（低内阻）高效率驱动（低功耗）



Die 尺寸缩小

Standard MCD of "A"

4.741mm^2=3.14mm x 1.51mm



42% 减少

缩小尺寸

2.748mm^2＝2.29mm×1.20mm

低阻抗Ron

⇒ **内置驱动器，带有低 Ron P通道／N通道-LDMOS（高达8A典型值）**

※Ron目标值：100～150mΩ（典型值）

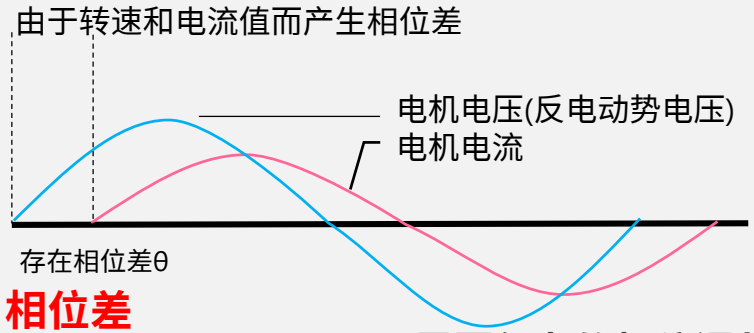
③ 先进的自调节 ~ Intelligent Phase Control ~智能相位控制

直流无刷

通过检测电机电流，自动调节电压和电流的相位来提高效率

传统技术

由于转速和电流值而产生相位差

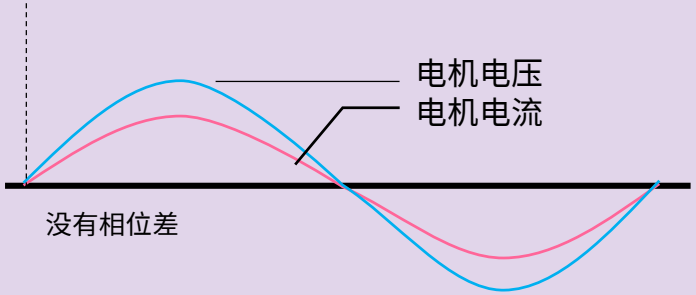


相位差
＝ 效率降低

⇒需要复杂的相位调节来提高效率.

新技术

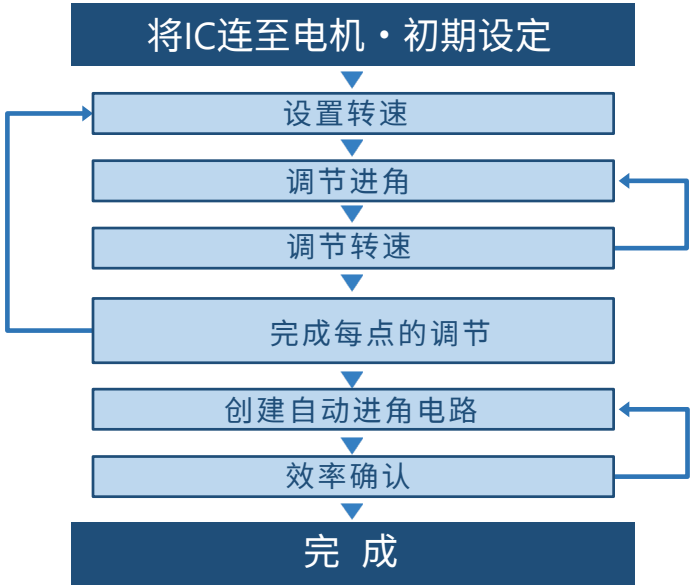
IC 自动将电流和电流同相.



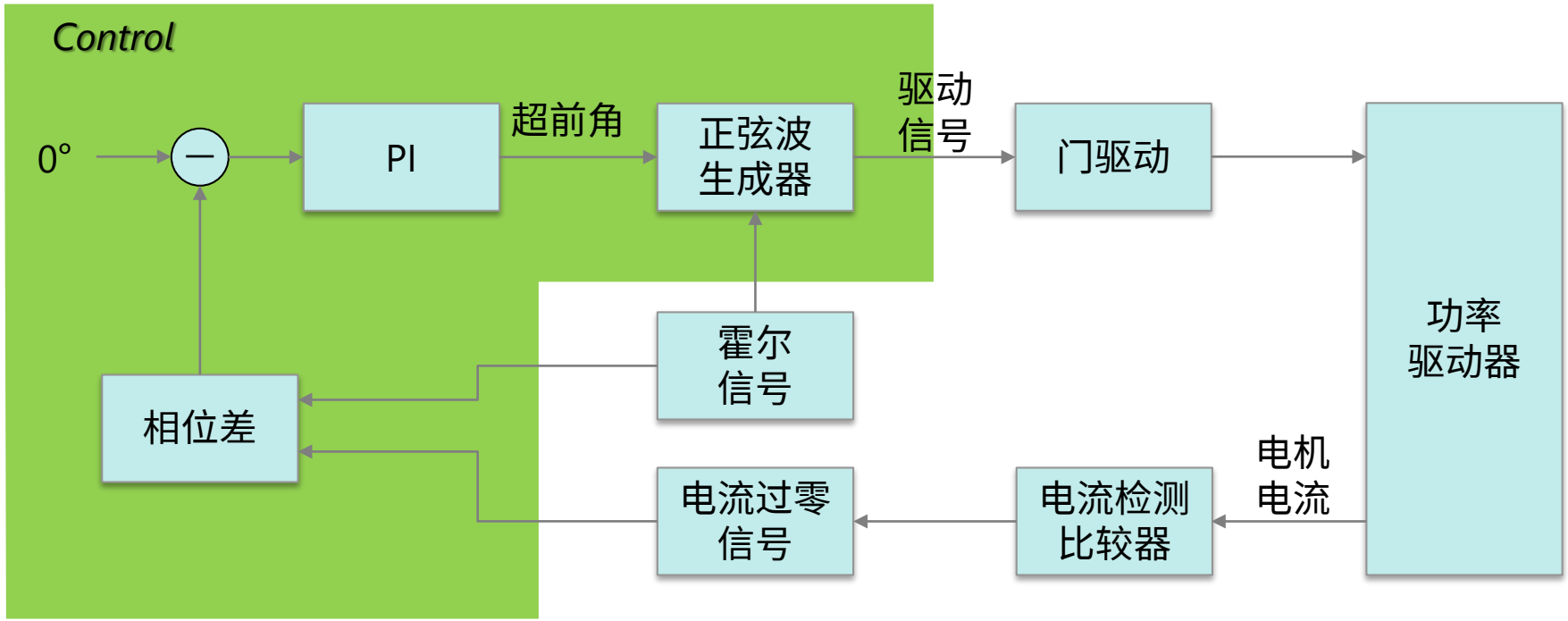
⇒自动优化相位
无需任何努力即可提高效率!

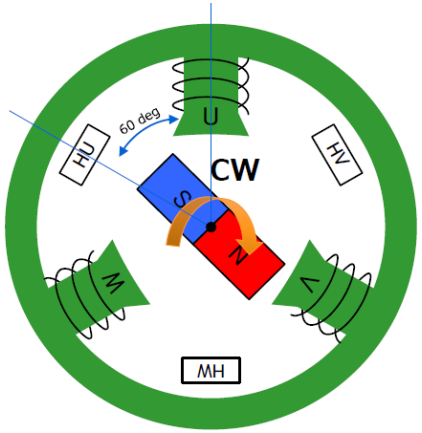
赞!

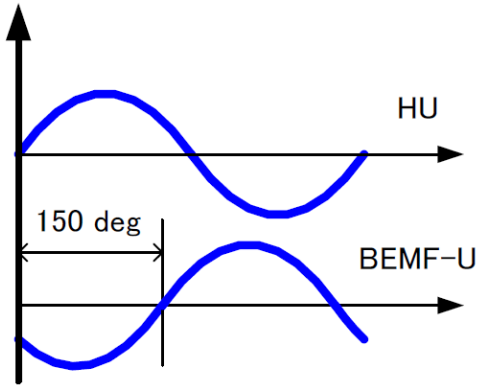
■调试步骤的示意

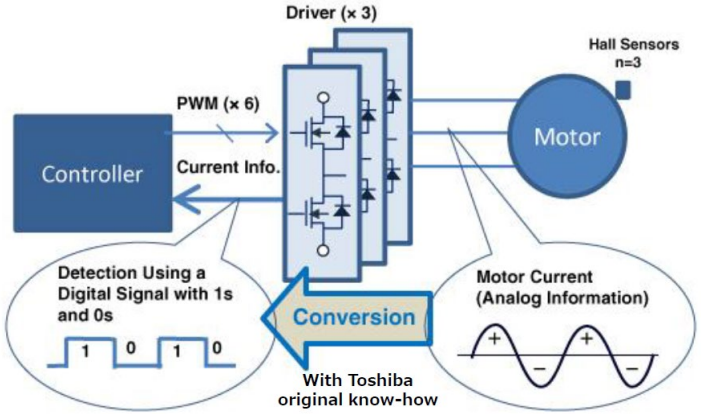


智能相位控制方框图



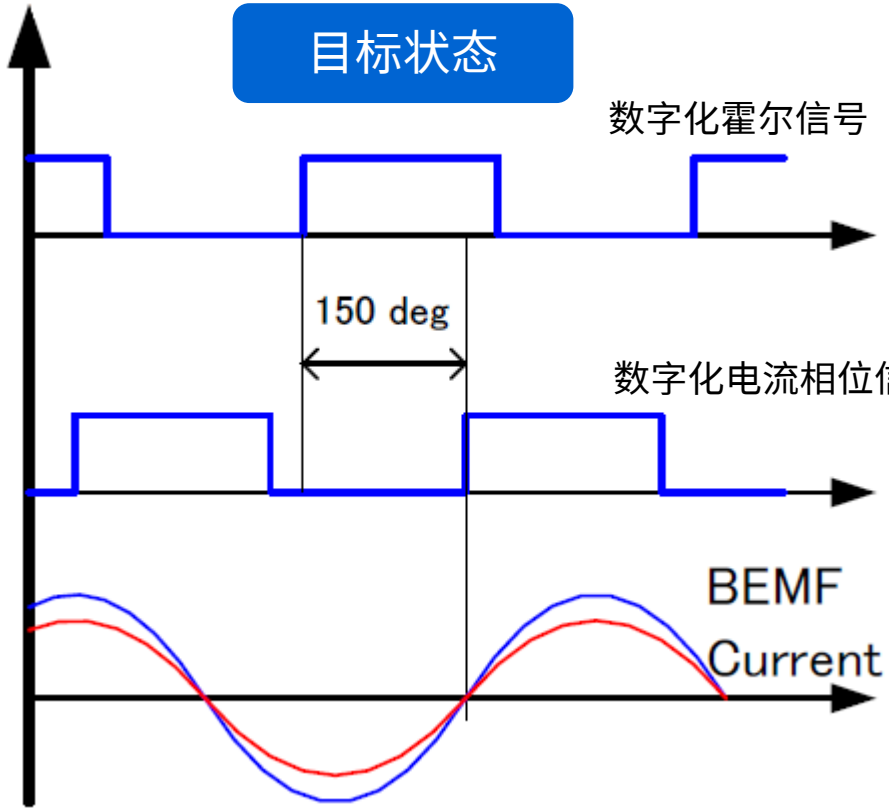




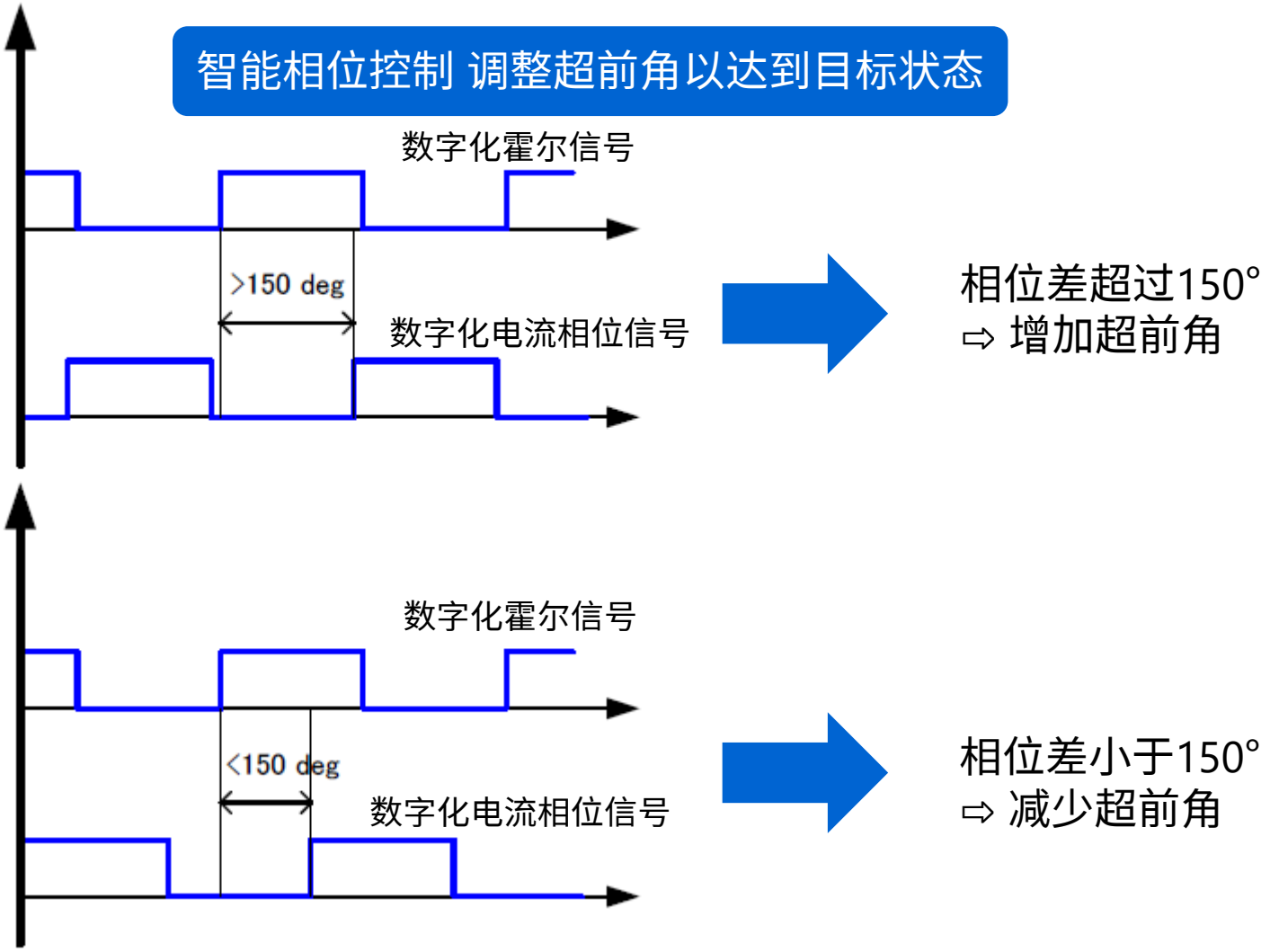


比较器检测电机电流过零点时，可以生成数字化的电流过零信号。

智能相位控制工作介绍



霍尔信号超前反电动势（BEMF）150°，如果霍尔信号也同样超前电流相位150°，则电流和BEMF相位是同步的，得到的效率是最高的。

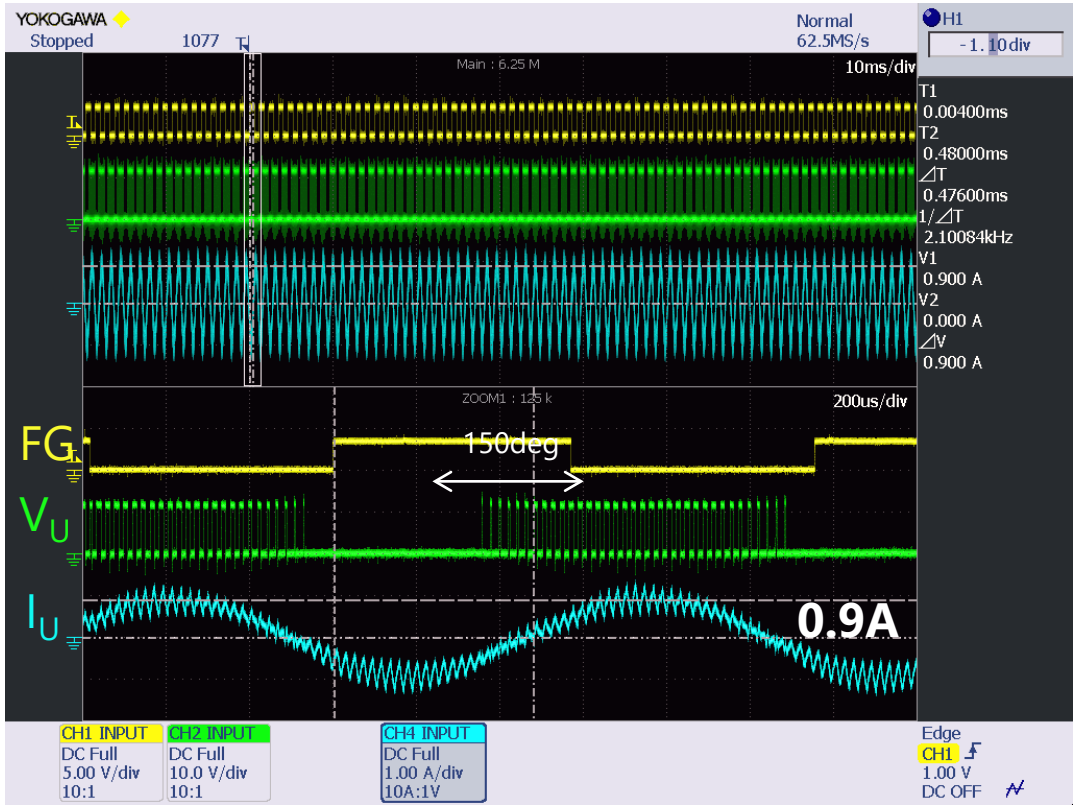


智能相位控制会判断电流相位是超前还是落后霍尔信号（反电动势）。如果连续4次超前（或落后），那么会按照每0.94°一次减少（或增加）超前角。

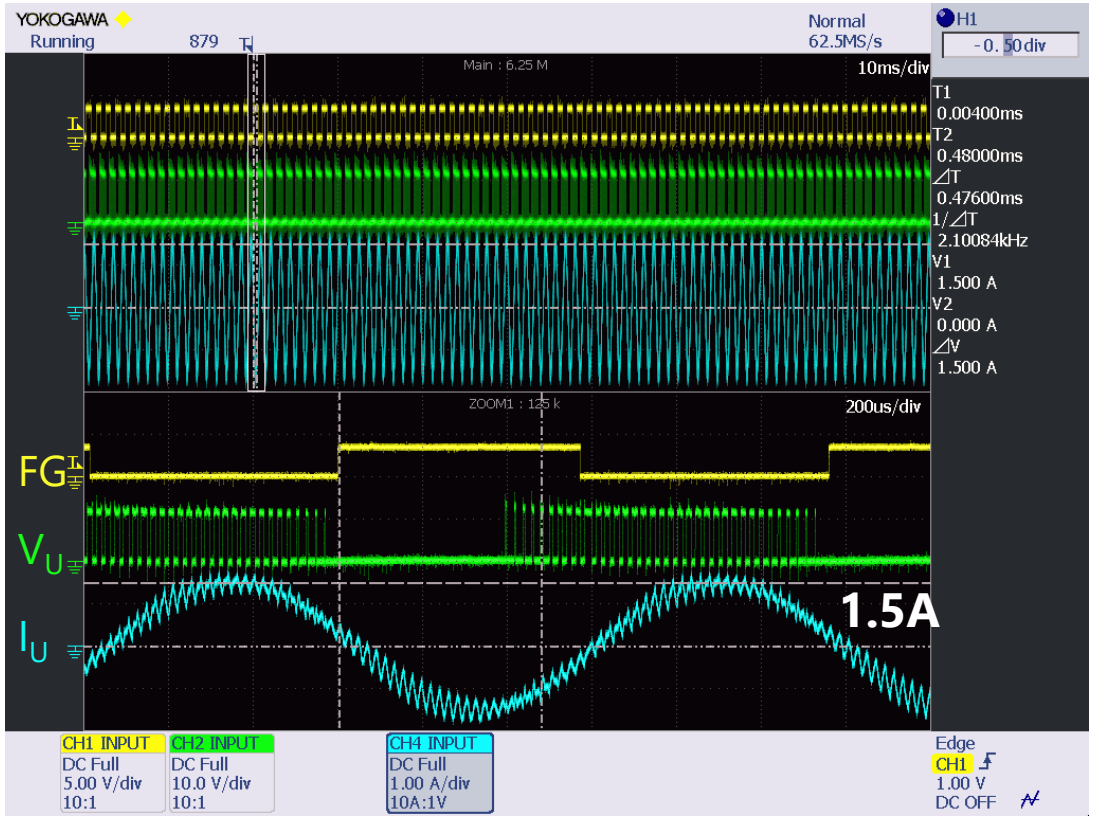
例：转速175000RPM

- with Intelligent Phase Control Iu =0.9A
- without Intelligent Phase Control (LA=0) Iu=1.5A

With Intelligent Phase Control



Without Intelligent Phase Control (LA=0)

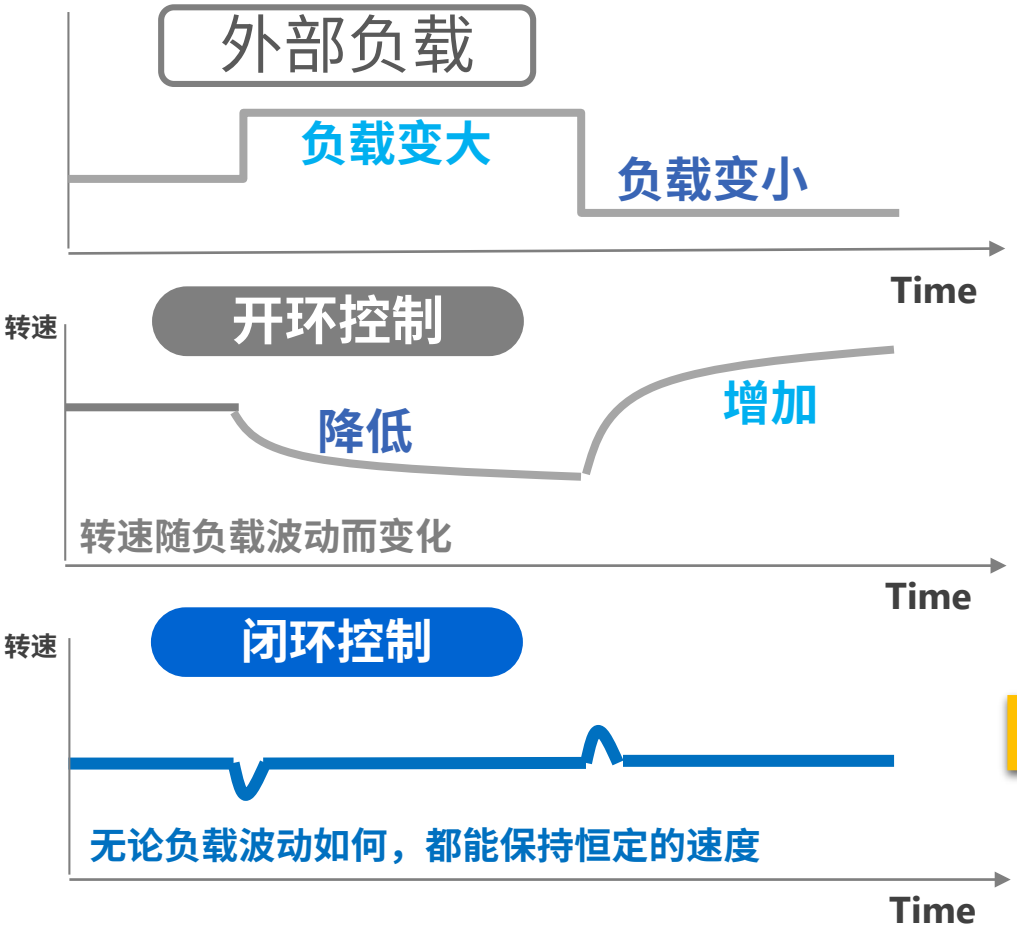


④ 速度控制信号更少 ~ Closed Loop ~

直流无刷

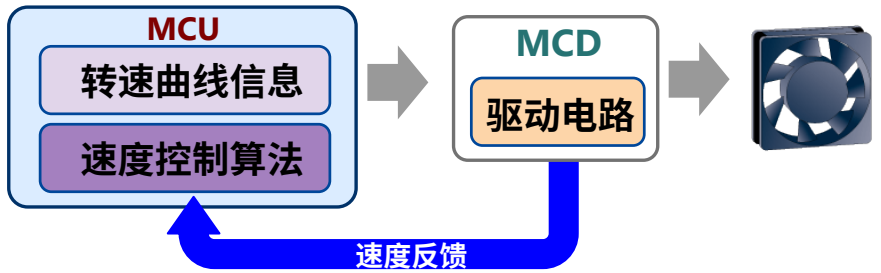
内置速度闭环控制

通过减少由于电压和负载变化引起的波动来提高旋转速度精度



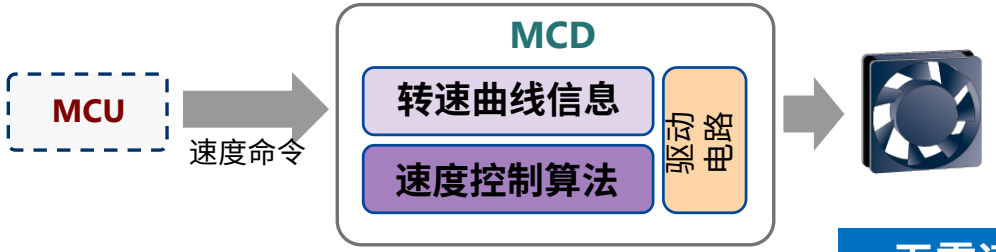
易于系统配置

传统



需要额外增加MCU和控制软件的开发

内置闭环控制的MCD



MCD内置速度闭环控制，外部只需要速度指令信号即可。

无需速度控制信号

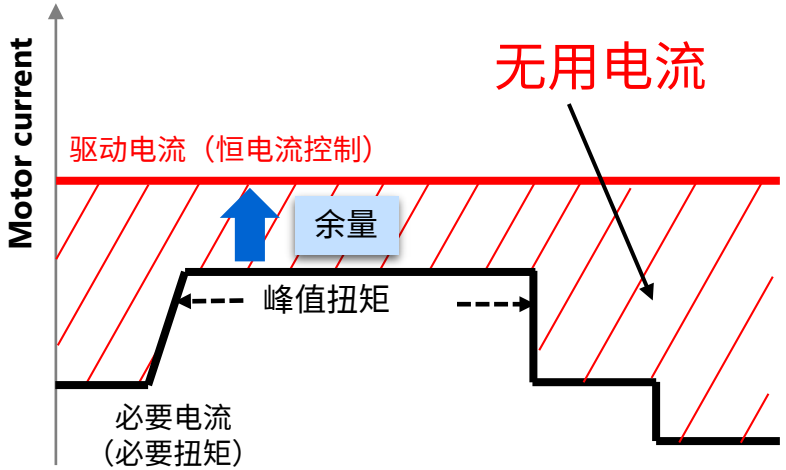
⑤ 自动电流优化 ~ AGC ~

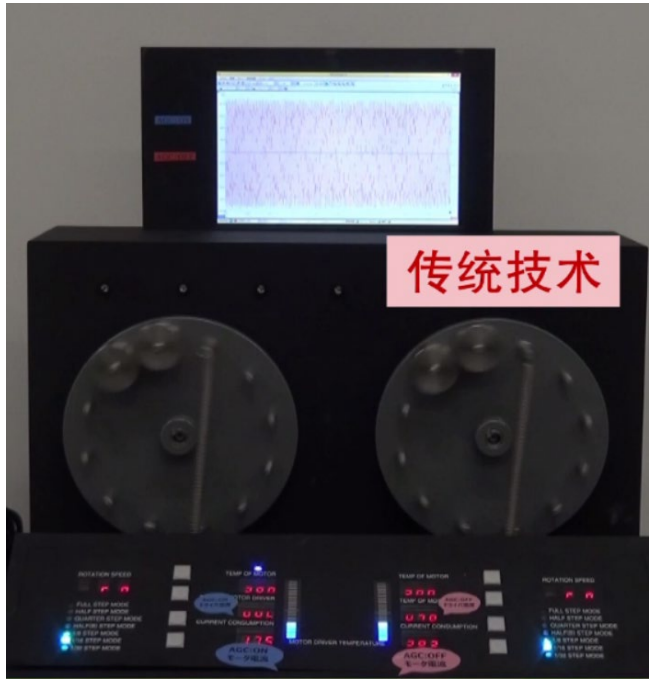
实时优化步进电机驱动电流，实现低功耗和低发热

■传统技术

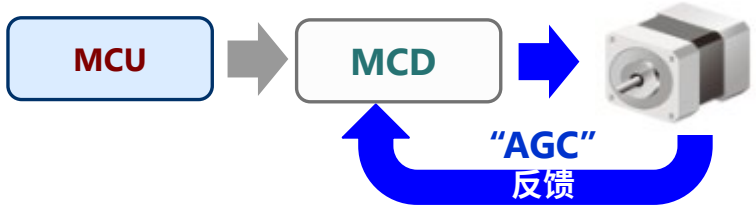
开环控制

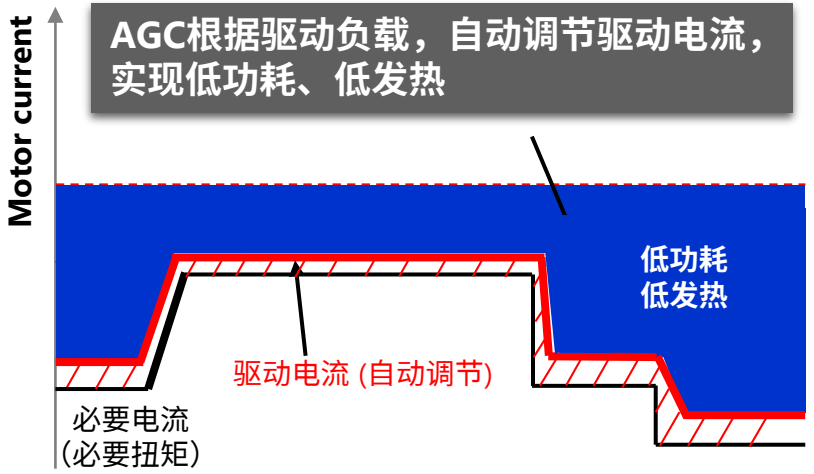
"开环控制"使用恒定驱动电流，并且电流足够大以保证最大负载条件下也不发生丢步。
因此在轻载条件下**驱动效率低**。

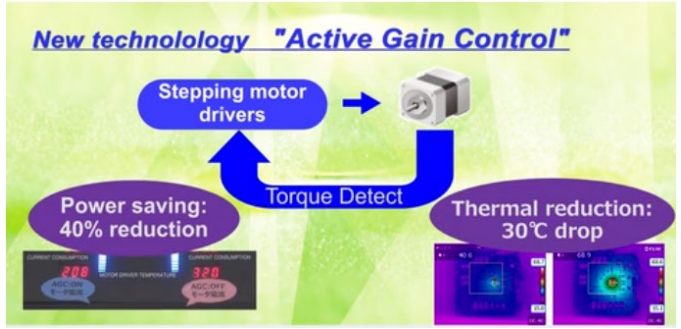




■新技术"Active Gain Control"







■优点

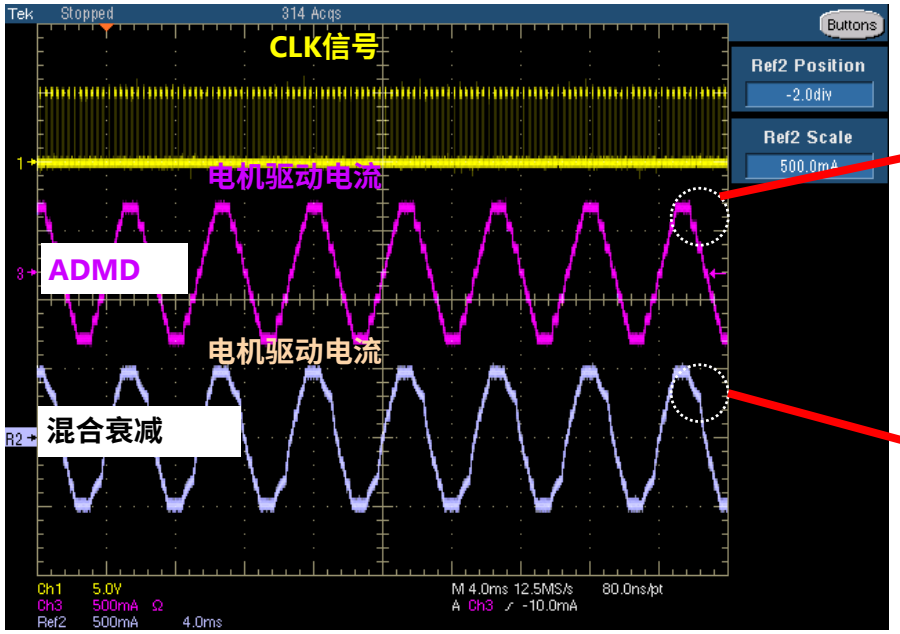
★自动优化电流／防止丢步
=> 低功耗／低发热

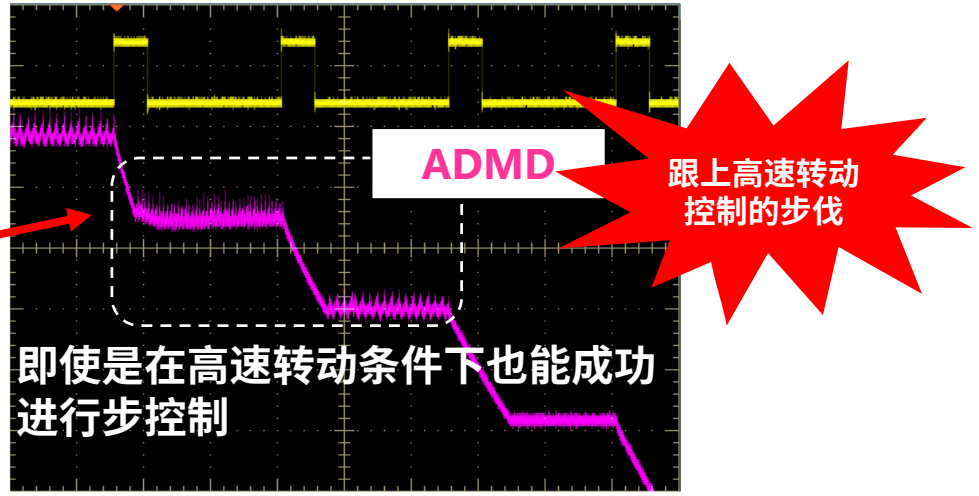
支持产品：
・TB67S279 ／ 289 ／ 285 ／ 249 ／ 128 FTG

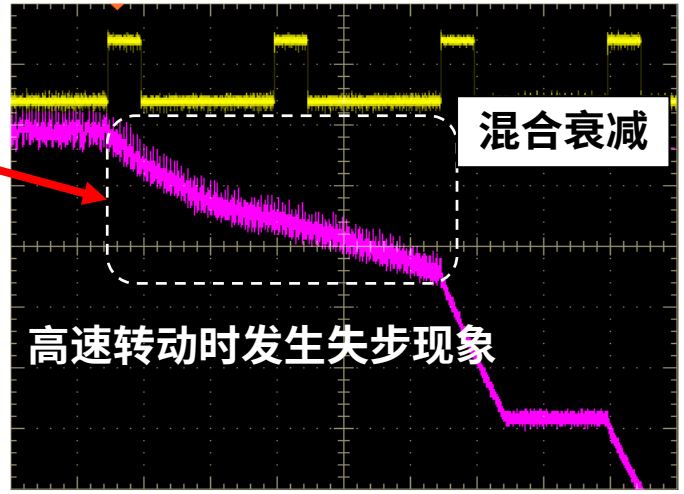
⑥ 高级动态混合衰减 ~ ADMD ~

先进的微步驱动技术，实现高速转动＋高效率＋低噪声

高速转动时的电流波形比较





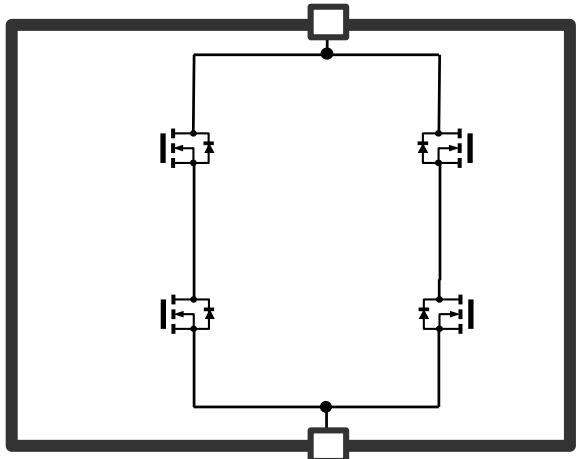


与传统的混合衰减相比，ADMD能改进电流后续跟进步伐，
实现高速转动时的高效电机控制。

⑦ 节省BOM成本~ ACDS ~

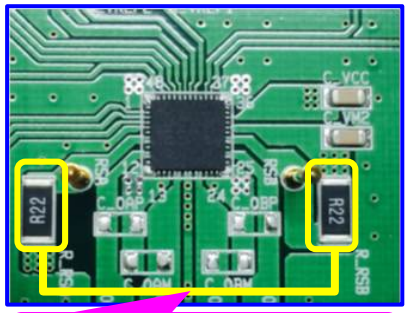
ACDS技术有利于降低BOM成本，改进恒流精度

一般系统
需要外部RS电阻



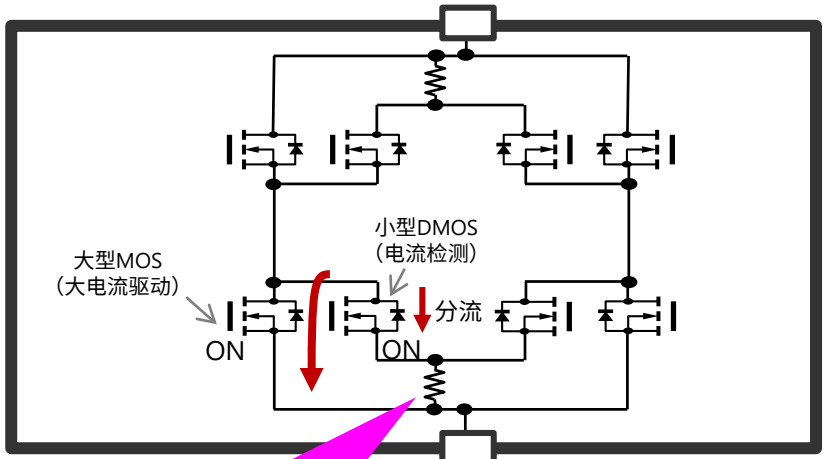
RS电阻

通过外部电阻检测电流

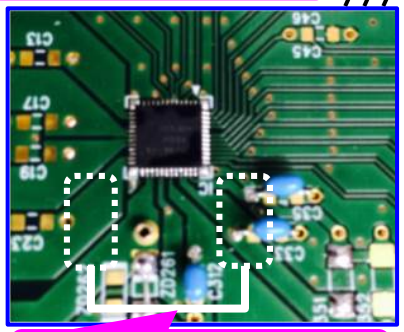


需要两个大的外部电阻

ACDS
不需要外部RS电阻

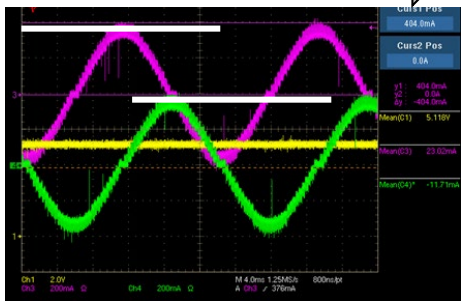


通过内部电阻检测电流



不需要外部电阻
自由布线，节省成本

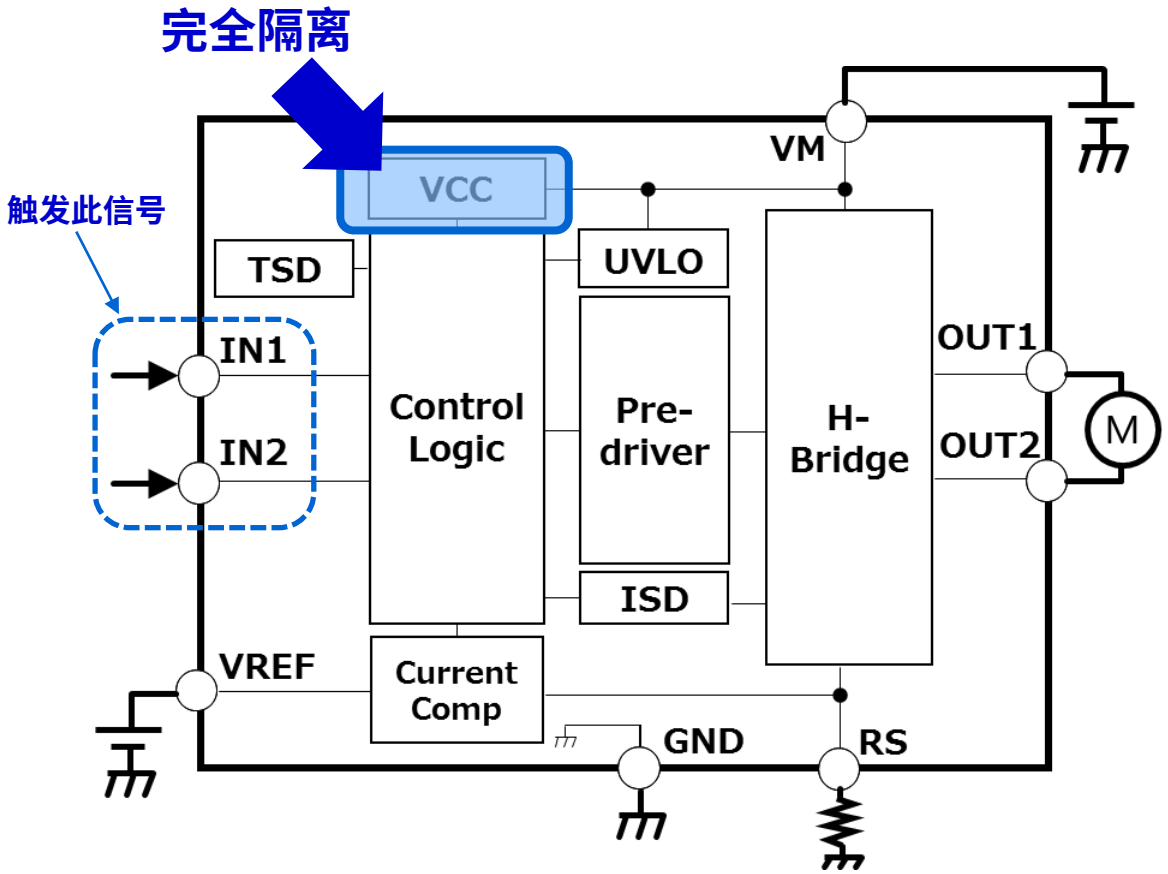
恒流精度：低于6%



支持产品：
- TB67S141／142／149 /179 / 508 / 249/ 279 / 289 / 128

⑧ 低功耗技术（低泄漏电流）

由于降低了功耗，因此扩展了对电池供电产品的应用。
高压产品中的待机电流最大为1uA



■常规操作

在待机期间，内部VCC稳压器正在工作（用于逻辑块电源）
（1mA） → 增加功耗

■减少电流小号

待机期间，内部VCC稳压器关闭（1μA）。
无需待机引脚。

新技术

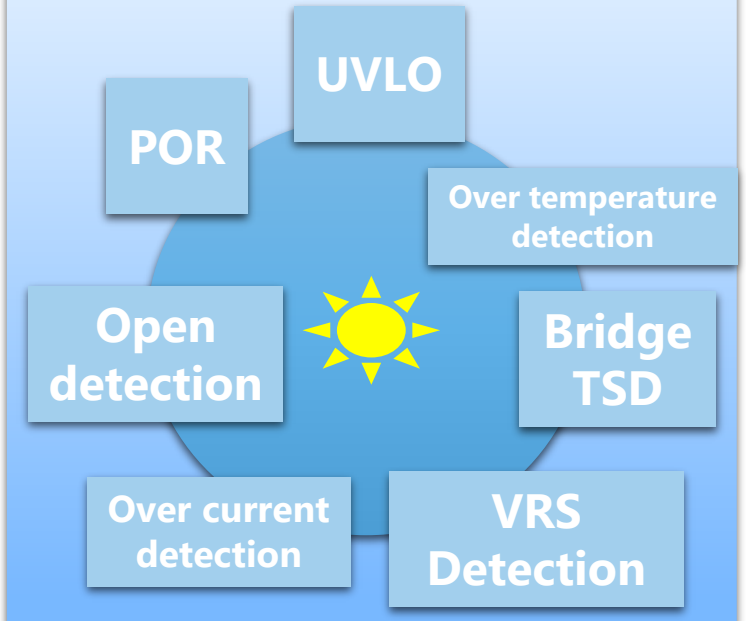
根据控制输出H桥的输入信号（IN1／IN2）的状态关闭VCC。
VCC完全隔离，将消耗电流降至 Max：1μA

TOP 行业级别

⑨ 高品质，高可靠性

异常检测，高精度控制和高抗噪性产品阵容

异常检测

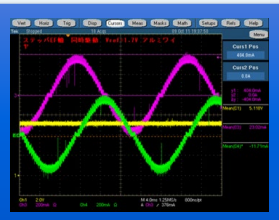


具有全规格检测的MCD可实现世界上最好的安全性功能!

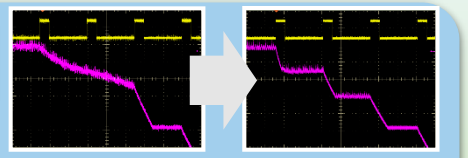
高精度控制

128Step

低振动控制



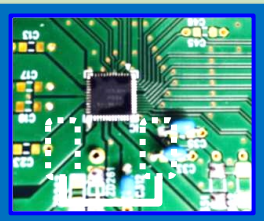
ADMD



低纹波控制

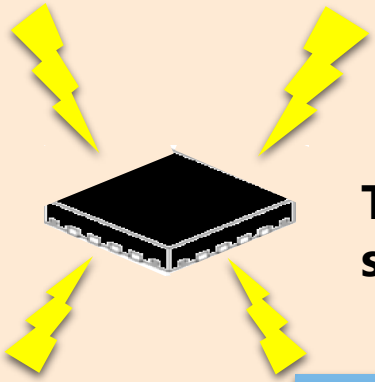
ACDS

控制组件少



东芝的MCD实现3合1！

抗噪声产品



TB67S10x series etc

Many achievements in Amuse high noise environment

※空气放电超过20kV的产品阵容

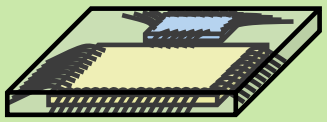
做世界上最好的IC。

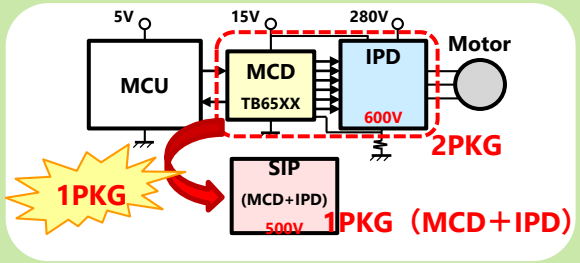
⑩ 独特的融合技术 （SiP／PMMCD）

具有600V输出的多个芯片放在一个内置DC-DC转换器的封装中

SiP（System In Package）

MCD（Controller）+ IPD（500V／600V）SiP方案



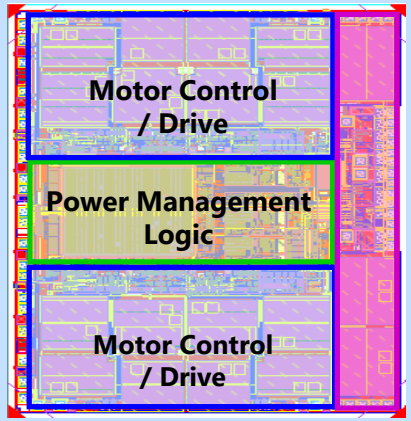


空调风扇电机只需要一个IC即可控制.

IPD（500V／600V）和 MCD（Controller）使用SiP技术封装在一个IC内。

PMMCD（Power management MCD）

DCDC+MCD 1 chip方案



高精度和高电流的DC-DC
＋
高压多通道MCD

2MHz high speed DCDC technology established

4chHSW(MCD)
＋
3ch DCDC converter
＋
LDO embarkatio

开发中

无刷直流电机驱动器／控制器路线图（非车载类）

直流无刷

针对3相BLDC应用，扩大智能相位控制和Closed loop产品线

三相风机（高电压）

Driver

- 2A 500V 3霍尔 正弦 — TB67B000 HG FG
- New 【600V SiP】 2A 600V 3霍尔 正弦 — TB67B000A

Controller /Pre-driver

- 2mA 12V 3霍尔 正弦 — TB6551
- 2mA 18V 3霍尔 正弦 — TB6584A
- 2mA 18V 3霍尔 方波 — TB6586B
- New 2mA 18V 3霍尔 正弦波 智能相位控制 — TC78B041/42

Under Planning

- 1.5A 600V 3霍尔 正弦 — 600V智能相位控制
- 2.5A 600V 3霍尔 正弦 — 600V智能相位控制

FET Output

三相风机（低电压）

Driver

- 3A 36V 1霍尔 方波 — TC78B015A
- [InPAC驱动器] 3A 40V 3霍尔 正弦 — TC78B016 智能相位控制
- New [1霍尔&正弦波+闭环] 3.5A 18V 1霍尔 正弦波 智能相位控制 — TC78B025FTG
  - 正弦波
  - 闭环
- Drive current Variation
- New 0.2A 30V 无感 方弦 — TC78B009FTG
- 3A 25V 无感 方波 — TB67B001／008

Controller /Pre-driver

- 20mA 30V 3霍尔 正弦 — TB6605
- 0.1A 31V 3霍尔 正弦 — TC78B004FTG 闭环FLL+PLL
- New [1霍尔&正弦波+闭环+预驱] 0.1A 18V 1霍尔 正弦 智能相位控制 — TC78B027FTG
  - 正弦波
  - 闭环
- 2mA 18V 3霍尔 正弦 — TB6634

Sensorless Square Wave TC78Bxxx

单相风机

- 1.5A 18V 1霍尔 正弦 — TC78B002
- 20mA 40V 1霍尔 正弦 — TC78B006

驱动器 / 控制器预驱动器

量产 / 正在开发 / 计划中

~2017 | 2018 | 2019 | 2020~

TC78B041FNG／TC78B042FTG

18V/2mA 3-sensor type Sine wave drive 3-Phas BLDC Motor controller

Mass production

典型应用

- 空调风扇
- 空气净化器

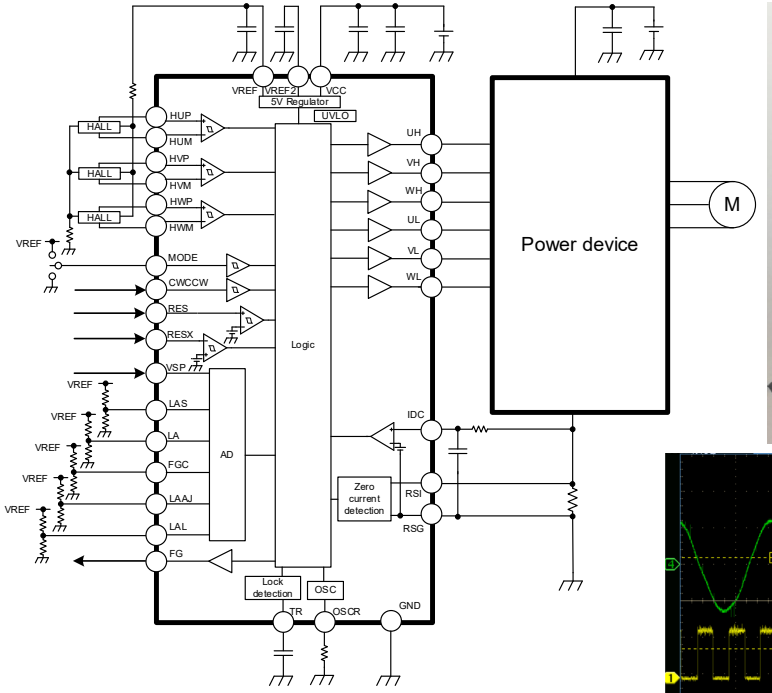
功能特点

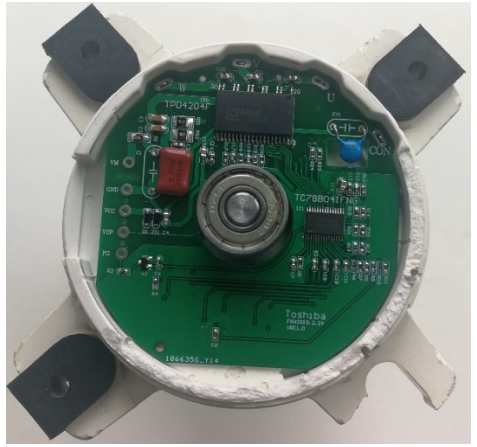
- Intelligent Phase Control：
  智能相位控制，无需调整
- 三相有感霍尔正弦波控制
- 电机锁定检测功能
- 可选霍尔元件或者 霍尔IC信号输入
- 正反转
- 工作电压范围 : 6V～16.5V
- 限流电压 : 0.5V + ／ - 4 %
- 速度输入命令可选
  - 2.1V-5.4V (TB6584 type)
  - 0.2V-5.0V (TB6551 type)
- 可选FG转速反馈脉冲信号
  3 , 2.4 , 2 , 1 and 0.8 pulse／electric angle
- 内置5V ／ 35mA电源输出

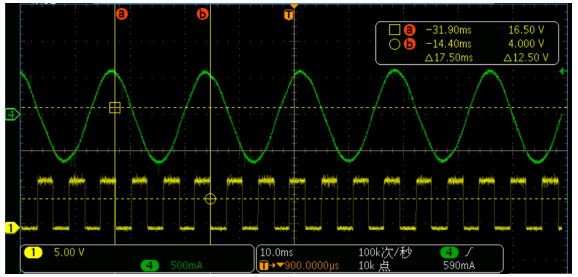
产品状态

- 量产中

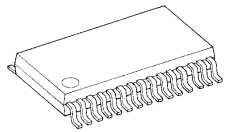
应用方框图



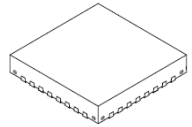




封装



TC78B041FNG：SSOP30



TC78B042FTG：VQFN32

TB67B000AHG／AFG

600V/2A Sine-wave type 3-Phase BLDC Motor Driver

典型应用

■ 家电类, 高压风扇
（空调, 空气净化器, 天花机等）

功能特点

■ **SiP : System in Package**
控制器+ IPD(600V) 内置: 成本降低，PCB尺寸降低

■ **600V／2A**

■ 180°／150° 换相
低噪音、高效率

■ 位置检测输入
霍尔元件 ／霍尔 IC

■ 内置振动(仅需电阻器)

■ 固定超前角控制

■ 过温／过流／锁定检测

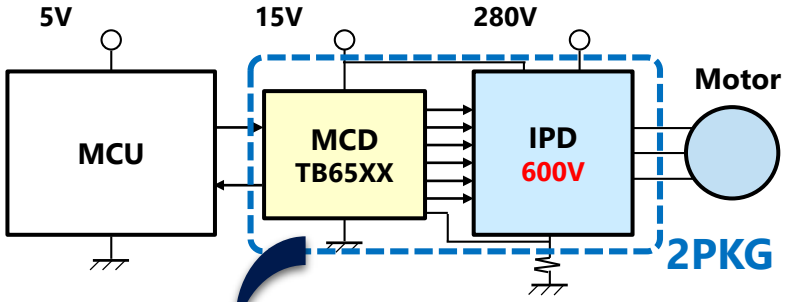
■ FG脉冲：1or3 pulses ／ 360°

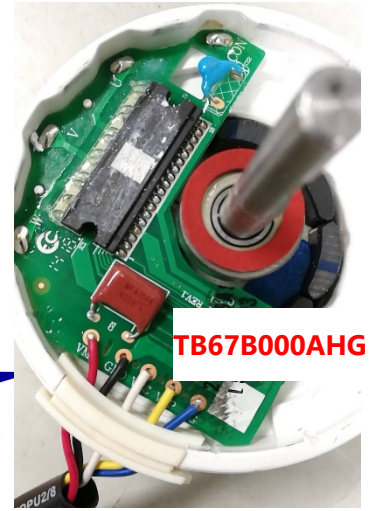
■ Ta = -30 to 115℃

产品状态

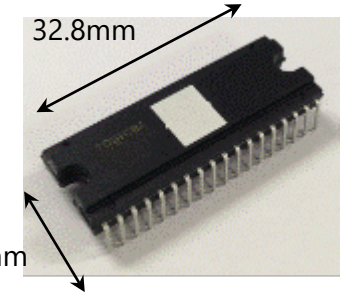
AHG ■ 量产中　　**AFG** ■ 量产中

SiP (System in Package)

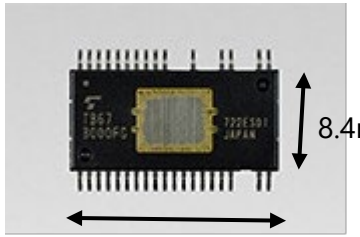




封装



TB67B000AHG : HDIP30



TB67B000AFG : HSSOP34

TC78B025FTG

18V/3.5A Sinewave 1-sensor type 3-phase BLDC Motor Driver

典型应用

■ 12V 冷却风扇
(PCs, Servers, Games, etc.)

功能特点

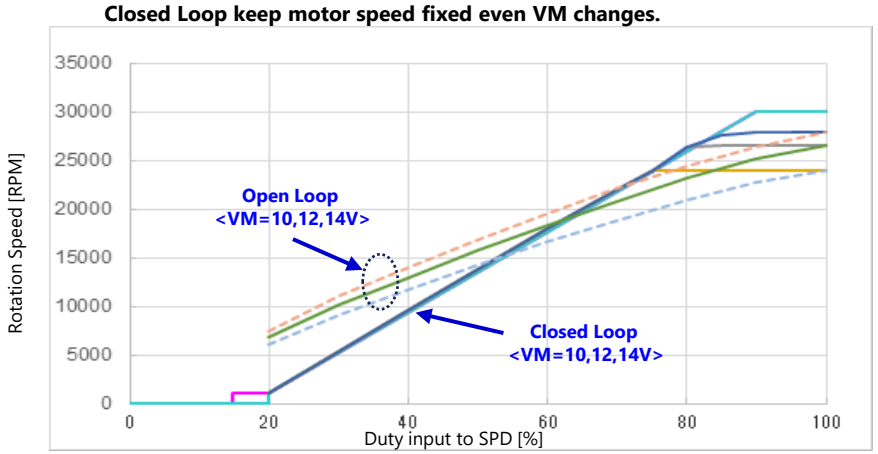
- **1-Hall 正弦波／150°方波 驱动**
  低噪音驱动, BOM 减少
- **内置速度闭环控制，可配置速度曲线**
- **低导通电阻：Rds(on)(H+L)=0.2Ω(typ.)**
- **SPI 接口**
- **内置非易失性存储器（NVM）**
- **工作电压范围：4.5～16V**
- **内置多种保护电路：热关断（TSD）、欠压锁定（UVLO）、过压保护（OVP）、电荷泵欠压保护、过电流保护（ISD）、输出电流极限保护（OCP）、锁定检测保护。**

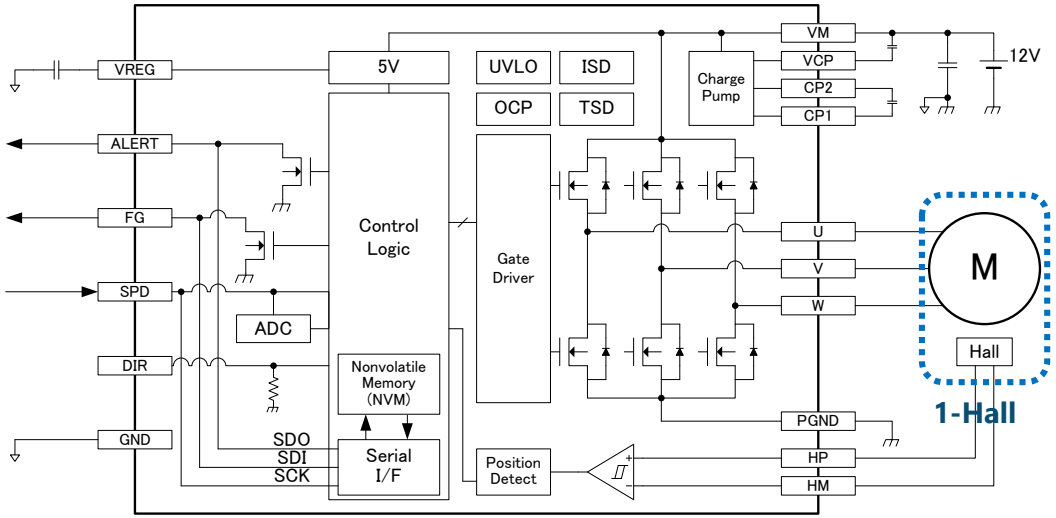
产品状态和封装

■ **量产中**

QFN24
（4.0×4.0mm）

闭环控制





TC78B009FTG

30V 3-phase BLDC Square wave Sensorless Pre Driver

典型应用

■ 冷却风扇，水泵，真空吸尘电机

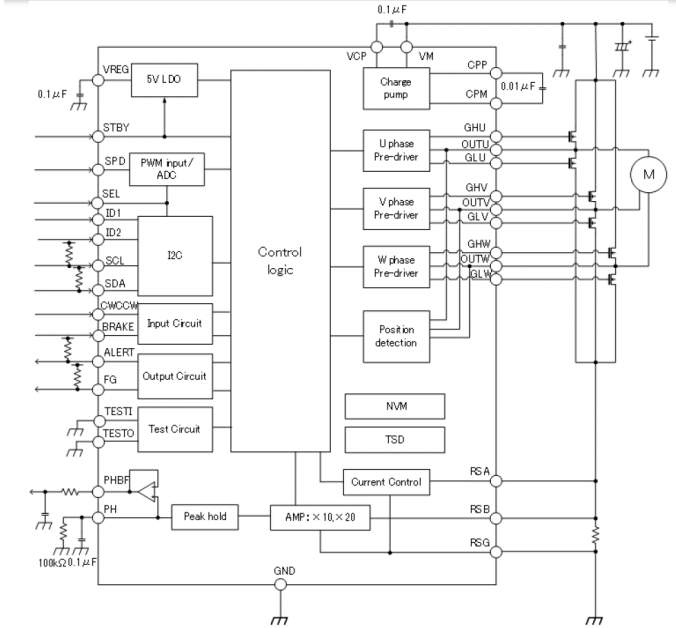
功能特点

- **无感 120°~150° 可选方波驱动**
- **具有调速曲线的内置闭环转速控制**
- **通过模拟电压、PWM占空比或I2C控制电机转速**
- **Nch + Nch 预驱动**
  - ⋙ **8档可设门驱动电流**
  - ⋙ **Max.**100mA sink, 200mA source
- **宽电压工作范围**
  - ⋙ **5.5 ~ 27V（绝对最大额定值：30V)**
- **待机功耗可达：0uA(type)**
- **内置电流监测输出**
- **FG转速输出／锁定检测**
- **刹车／正反转控制**
- **过流、过热、欠压、过流、堵转等保护**

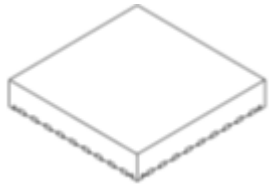
产品状态

■ **量产中**

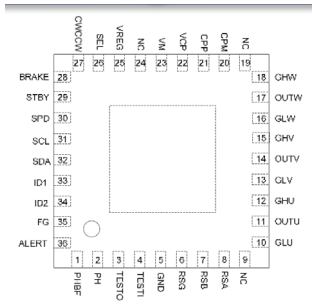
闭环控制



封装

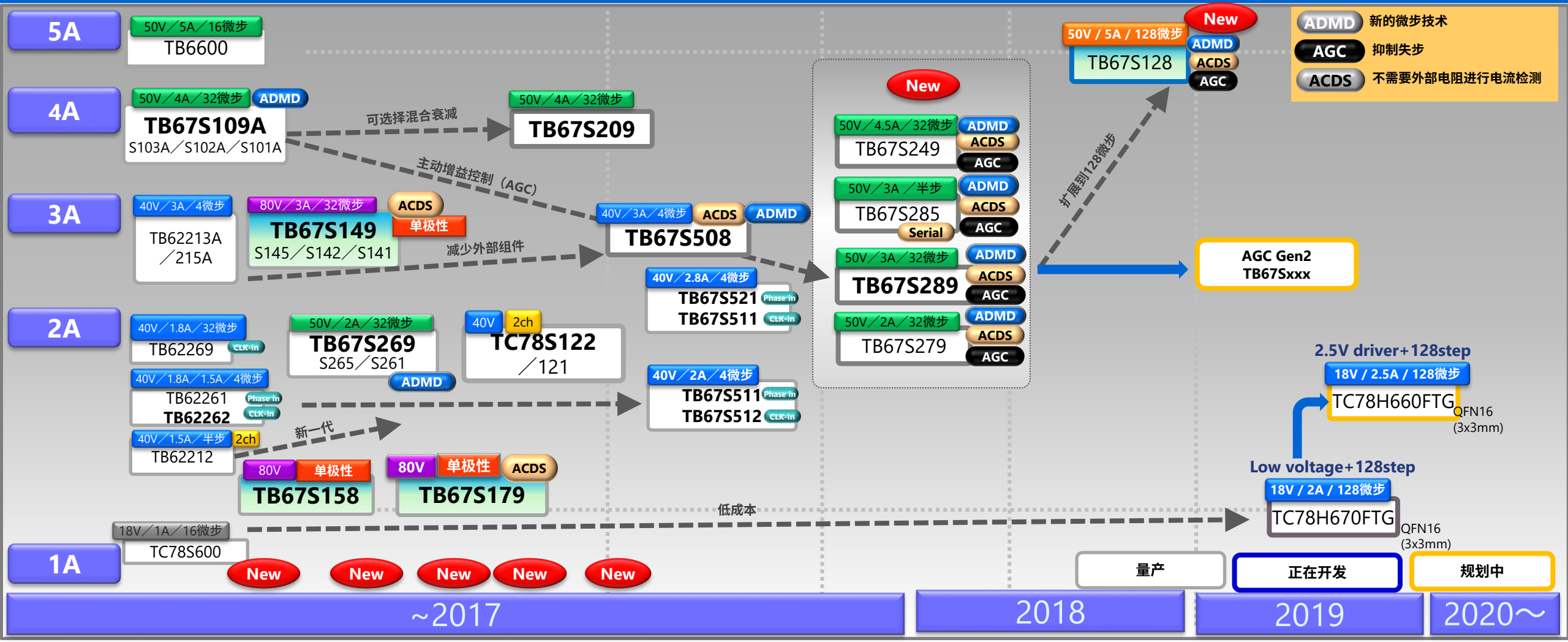


QFN36
(5.0 x 5.0 mm)



步进电机驱动IC产品路线图

发展AGC技术及扩展低压产品阵容



TB67S128FTG

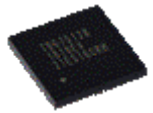
50V，5.0A , 128step(max) 1ch Stepping Motor Driver

典型应用

■ 打印机、监控设备、3D打印机、移动设备等

功能特点

■ **Multi-I/F**
→Clock-in控制和串行控制
■ **低导通内阻**
→0.25Ω（高压侧+低压侧；典型值）
■ **步分辨率**
→全步、半步、1/4步、1/8步、1/16步、1/32步、
1/64步、1/128步运行
■ **多故障检测功能**
→过热、过流、欠压、上电复位、电机负载开路保护
■ **带有散热焊盘的小封装**
→QFN64（9mm×9mm）



产品状态

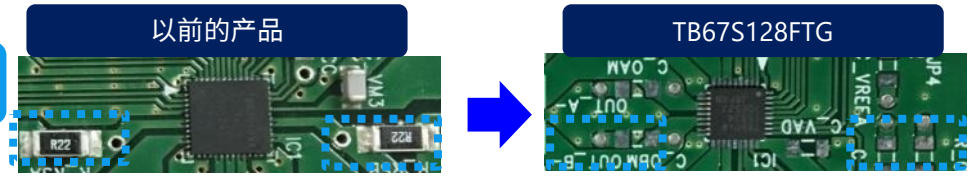
■ 量产中

*1 : ACDS is "Advanced Current Detect System"
*2 : ADMD is "Advanced Dynamic Mixed Decay"
*3 : AGC is "Active Gain Control"

东芝独特技术

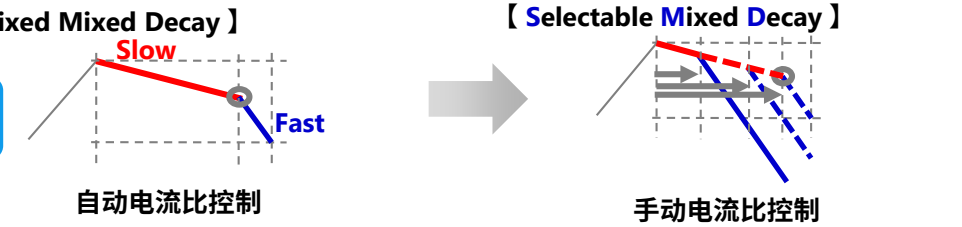
ACDS*1

集成电流检测功能可从板上取出检测电阻，并节省空间和成本.

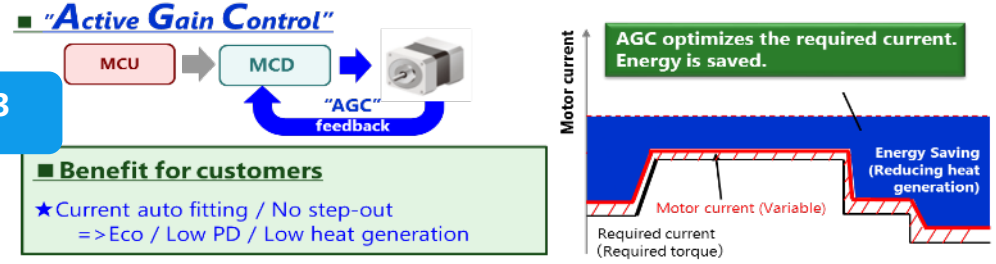


使用外部电阻器进行电流检测　　**集成电流感应**

ADMD*2



AGC*3



TC78H670FTG

18V，2.0A , 128step(max) 1ch Stepping Motor Driver

典型应用

■ 相机、监控摄像头、便携式打印机、手持式扫描仪、微型投影仪和智能手机

功能特点

■ **Multi-I/F**
→Clock-in 控制和串行控制

■ **工作电压 VM**
→2.5~16V（逻辑控制电平：1.5~5.5V）

■ **低导通内阻**
→0.48Ω（高压侧+低压侧；典型值）

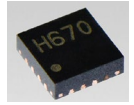
■ **步分辨率**
→全步、半步、1/4步、1/8步、1/16步、1/32步、**1/64步、1/128步**运行

■ **ACDS**
→消减电流检测电阻

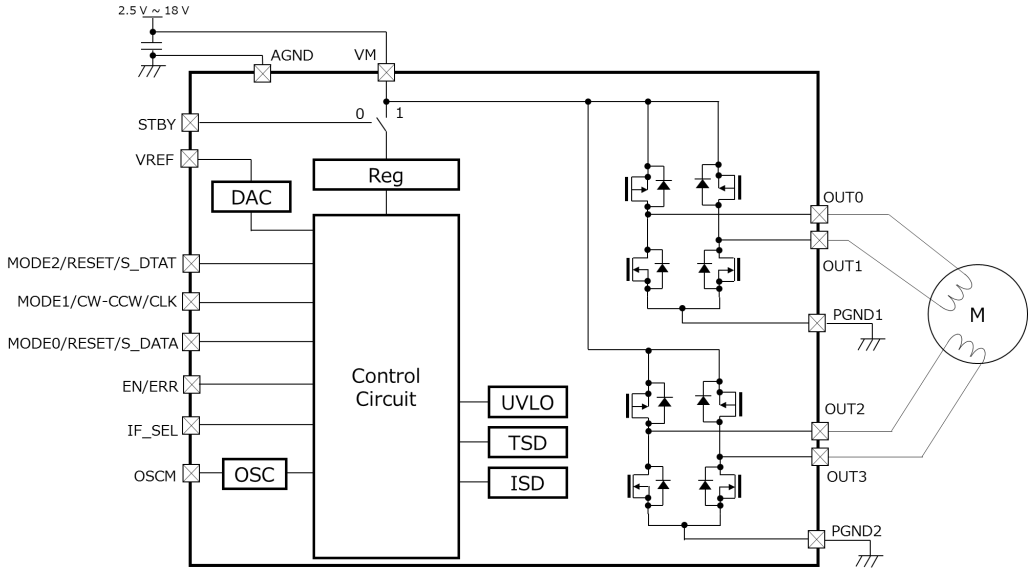
■ **待机功耗**
→0.1uA（type）

■ **安全功能**
→过热、过流、欠压锁定、电机负载开路保护

■ **带有散热焊盘的小封装**
→QFN16（3mm×3mm）



方框图

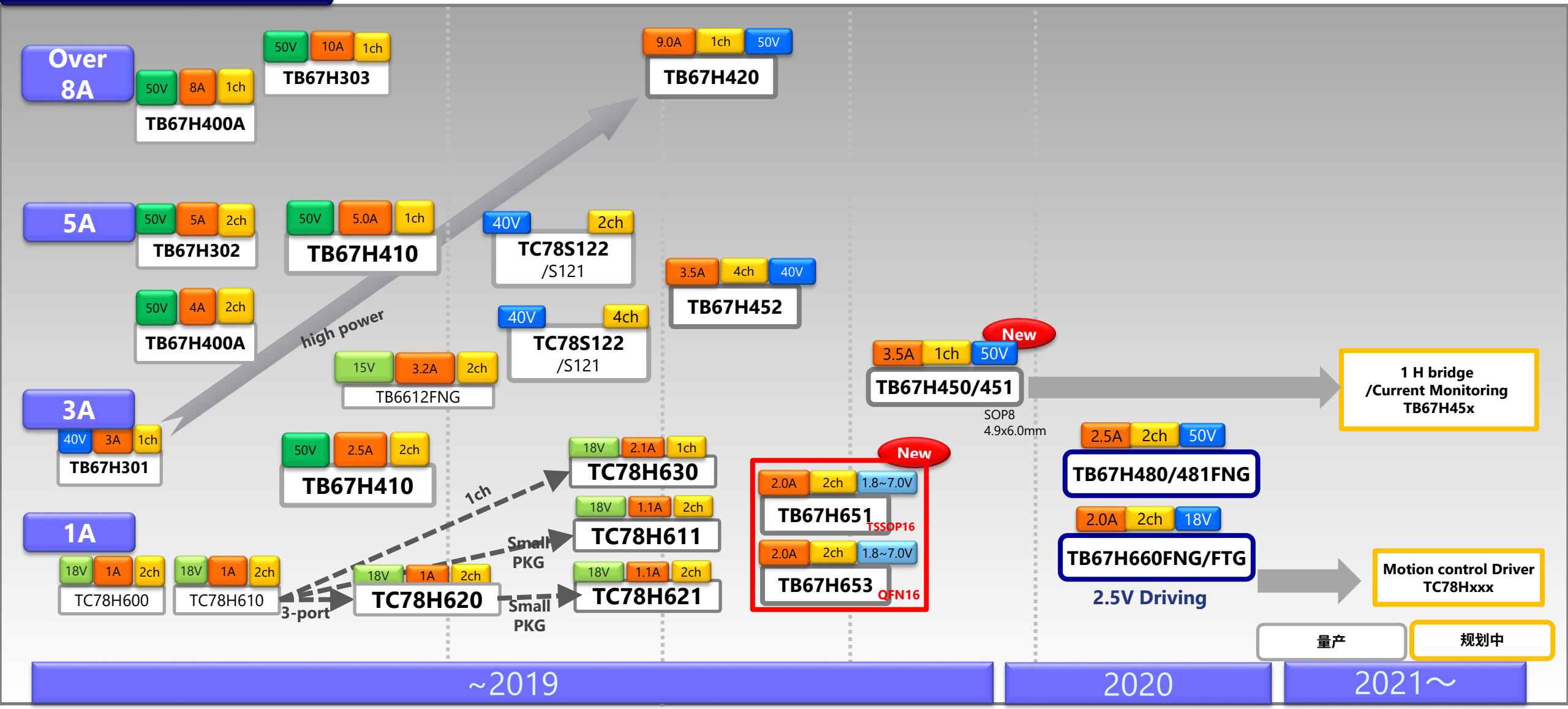


产品状态

■ 量产中

直流有刷电机驱动器路线图

用于直流有刷电机



TB67H450FNG／H451FNG

50V/3.5A 1ch Brushed DC Motor Driver

典型应用

- 扫地机器人
- 打印机及其他办公设备
- 工业设备

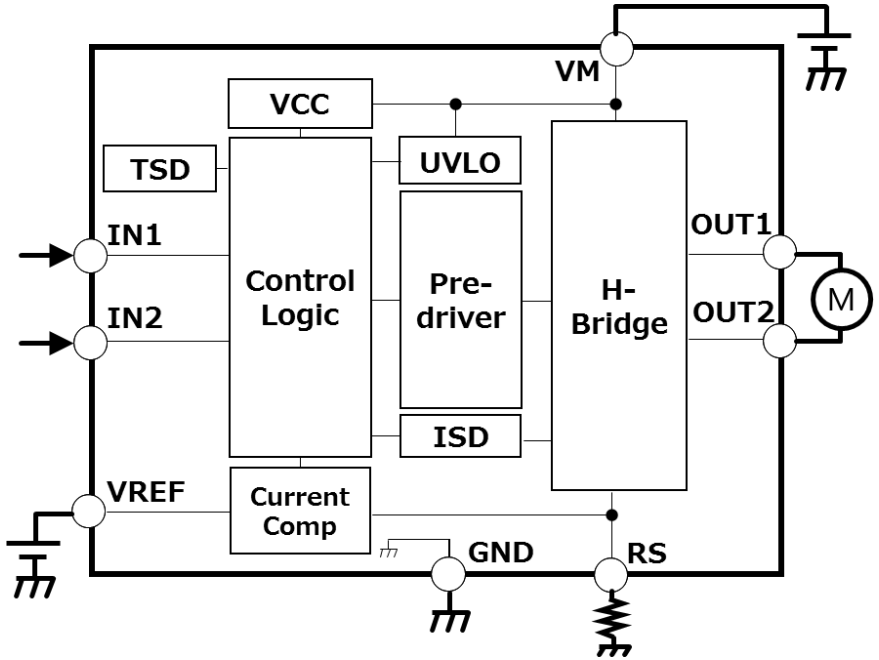
功能特点

- 采用HTSSOP8 pin封装，散热底盘
- 超低待机功耗：Max.1μA
- 低导通内阻：
  Rds(on)(H+L)=0.6Ω（典型值）
- 工作电压宽范围：
  VM=4.5至44V
- 可实现PWM恒流驱动和直接PWM驱动
  可通过VREF电压和检测电阻调节
- 内置多种错误检测功能：
  ISD, TSD, UVLO

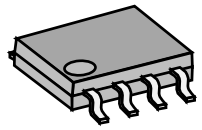
产品状态

- H450：量产中　　H451：量产中

方框图



封装

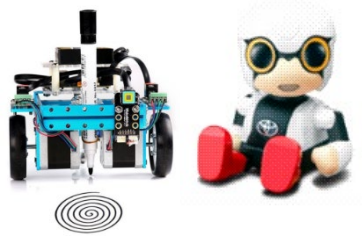


HTSSOP8
(4.9×6.0mm)

Battery application

Product name	TC78H611FNG	TC78H621FNG	TC78H630FNG	TC78H651FNG	TC78H653FTG
ch	2ch		1ch	2ch	2ch / 1ch
Rated value(Peak	18V/1.1A		18V/2.1A	7V/1.6A	2ch:8V/2.5A 1ch: 8V/5A
Operating voltage	VCC=2.7V～5.5V VM=2.5V～15V			VM=1.8V～6.0V	VM=1.8V～6.0V
Standby function	Built-in Standby current is 0μA(typ)			Built-in Standby current is 0μA(typ)	
PWM drive	Direct PWM			Direct PWM	
Mode	Forward/Reverse/ Brake/Stop/Standby	Forward/Reverse/ Stop/Standby	Forward/Reverse/ Brake/Stop/Standby	Forward/Reverse/Stop/ Standby	Forward/Reverse/ Brake/Stop/Standby
Detection function	Over thermal, Over current, Under Voltage			Over thermal, Over current, Under Voltage	
Ron	0.8Ω(typ.)		0.4Ω(typ.)	0.22Ω(typ.)	2ch:0.22Ω(typ.) 1ch:0.11Ω(typ.)
Package	TSSOP16 (5.2x6.4mm)			TSSOP16 (5.2x6.4mm)	QFN16 (3.0×3.0mm)

Smart toys



Smart Lock

Smart curtain

（1）BLDC电机控制IC 一产品线一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Part Number	Phases		Controller	Pre Driver	Driver	Maximum Ratings		Sensorless	Hall Sensor Inputs (Number)	Commutation		Lead Angle Control				Closed Loop	Temp. Range T_A	Package
	3-Phase	1-Phase				Voltage [V]	Current [A]			Square	Sine	External Input	Auto (current FB)	Auto (rpm FB)	Auto (Intelligent Phase Control)			
TB6575FNG ☆	●		●			5.5	0.020	●		●		●					-30 to +105°C	SSOP24
TB6551FAG ☆	●		●			12	0.002		3		●	●					-30 to +115°C	SSOP24
TB6556FG ☆	●		●			12	0.002		3		●	●	●				-30 to +115°C	SSOP30
TB6584AFNG ☆	●		●			18	0.002		3		●	●	●				-30 to +115°C	SSOP30
TB6584FNG ☆	●		●			18	0.002		3		●	●	●				-30 to +115°C	SSOP30
TB6586AFG ☆	●		●			18	0.002		3	●		●					-30 to +115°C	SSOP24
TB6586BFG ☆	●		●			18	0.002		3	●		●					-30 to +115°C	SSOP24
TB6586FG ☆	●		●			18	0.002		3	●		●					-30 to +115°C	SSOP24
TB6631FNG ☆	●		●			18	0.002		3		●	●		●			-30 to +115°C	SSOP30
TB6634FNG ☆	●		●			18	0.002		3		●	●	●				-30 to +115°C	SSOP30
TB67B054FTG ☆	●		●			18	0.002		3		●	●	●				-30 to +115°C	QFN32
TC78B041FNG * ☆	●		●			18	0.002		3		●	●			●		-40 to +115°C	SSOP30
TC78B042FTG * ☆	●		●			18	0.002		3		●	●			●		-40 to +115°C	QFN32

（1）BLDC电机控制IC 一产品线①一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Part Number		Phases		Controller	Pre Driver	Driver	Maximum Ratings		Sensorless	Hall Sensor Inputs (Number)	Commutation		Lead Angle Control				Closed Loop	Temp. Range T_A	Package
		3-Phase	1-Phase				Voltage [V]	Current [A]			Square	Sine	External Input	Auto (current FB)	Auto (rpm FB)	Auto (Intelligent Phase Control)			
TC78B002FNG	☆		●			●	18	1.5		1	●	●	●					-40 to +105°C	SSOP16
TC78B002FTG	☆		●			●	18	1.5		1	●	●	●					-40 to +105°C	QFN16
TC78B025FTG	* ☆	●				●	18	4.0		1	●	●	●		●	●	●	-40 to +105°C	QFN24
TC78B027FTG	* ☆	●			●		18	0.200		1	●	●	●		●	●	●	-40 to +105°C	QFN24
TB6633AFNG	☆	●				●	25	1.0	●		●		●					-30 to +105°C	SSOP24
TB6633FNG	☆	●				●	25	1.0	●		●		●					-30 to +105°C	SSOP24
TB67B001AFTG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	QFN36
TB67B001FTG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	QFN36
TB67B008AFNG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	SSOP24
TB67B008AFTG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	QFN24
TB67B008BFNG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	SSOP24
TB67B008BFTG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	QFN24
TB67B008CFNG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	SSOP24
TB67B008CFTG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	QFN24
TB67B008FNG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	SSOP24
TB67B008FTG	☆	●				●	25	3.0	●		●		●		●			-40 to +105°C	QFN24
TB67Z800FTG	☆	●				●	25	3.0										-40 to +105°C	QFN36
TC78B015FTG	☆	●				●	25	3.0		1	●		●		●			-40 to +85°C	QFN36
TB6603FTG	☆	●			●		30	0.020		3		●	●					-30 to +85°C	QFN36
TB6604FTG	☆	●			●		30	0.020		3		●		●				-30 to +85°C	QFN48
TB6605FTG	☆	●			●		30	0.020		3		●	●		●			-30 to +85°C	QFN36
TC78B009FTG	* ☆	●			●		30	0.240	●		●		●		●		●	-40 to +105°C	QFN36

（1）BLDC电机控制IC 一产品线②一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Part Number			Phases		Controller	Pre Driver	Driver	Maximum Ratings		Sensorless	Hall Sensor Inputs (Number)	Commutation		Lead Angle Control				Closed Loop	Temp. Range T_A	Package
			3-Phase	1-Phase				Voltage [V]	Current [A]			Square	Sine	External Input	Auto (current FB)	Auto (rpm FB)	Auto (Intelligent Phase Control)			
TC78B004AFTG		☆	●			●		31	0.100		3		●		●				-30 to +85°C	QFN40
TC78B015AFTG		☆	●				●	36	3.0		1	●		●		●			-40 to +85°C	QFN36
TC78B015BFTG	**	☆	●				●	36	3.0		3	●		●		●			-40 to +85°C	QFN36
TC78B015CFTG	**	☆	●				●	36	3.0		3	●		●		●			-40 to +85°C	QFN36
TC78B006AFNG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	SSOP16
TC78B006AFTG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	QFN16
TC78B006BFNG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	SSOP16
TC78B006BFTG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	QFN16
TC78B006CFNG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	SSOP16
TC78B006CFTG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	QFN16
TC78B006FNG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	SSOP16
TC78B006FTG		☆		●		●		40	0.020		1	●	●						-40 to +105°C	QFN16
TC78B016FTG		☆	●				●	40	3.0		3		●	●		●	●		-40 to +105°C	QFN36
TB6585AFTG		☆	●				●	45	1.8		3		●	●	●				-30 to +85°C	QFN48
TB6585FG		☆	●				●	45	1.8		3		●	●	●				-30 to +85°C	HSOP36
TB6588FG		☆	●				●	50	2.5	●		●		●					-30 to +105°C	HSOP36
TB67B000FG		☆	●				●	500	2.0		3	●	●	●					-30 to +115°C	HSSOP34
TB67B000HG		-	●				●	500	2.0		3	●	●	●					-30 to +115°C	HDIP30
TB67B000AFG	*	☆	●				●	600	2.0		3	●	●	●					-30 to +115°C	HSSOP34
TB67B000AHG	*	-	●				●	600	2.0		3	●	●	●					-30 to +115°C	HDIP30

（2）步进驱动IC 一产品线（CLK输入）①一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Note (1): Low voltage Detection
(2): Over Current Detection
(3): Heat Detection

Part Number		Motor Type		Interface			Maximum Ratings		Stepping Mode								Acrive Gain Control	Single Power Supply	Protection			Temp. Range T_A	Package
		Bipolar	Unipolar	Clock	Phase	Serial	Voltage [V]	Current [A]	Constant Current Cont.	Full	Half	1/4	1/8	1/16	1/32	1/64	1/128			UVLO (1)	ISD (2)	TSD (3)		
TB6613FTG	☆	●		●		●	6	0.8	●		●					●				●		●	-20 to +85℃	QON44
TB6608FNG	-	●		●			15	0.8	●	●	●	●	●							●		●	-20 to +85℃	SSOP20
TC78H670FTG *	☆	●		●		●	18	2.0	●	●	●	●	●	●	●	●	●		●		●	●	-40 to +85℃	QFN16
TC78S600FNG	-	●		●			18	1.0	●		●	●	●	●						●	●	●	-20 to +85℃	SSOP20
TC78S600FTG	-	●		●			18	1.0	●		●	●	●	●						●	●	●	-20 to +85℃	QFN24
TB6615PG	-		●	●			28	0.4		●	●												-30 to +85°C	DIP16
TB62211FNG	☆	●		●			40	1.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP24
TB62214AFG	☆	●		●			40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	HSOP28
TB62214AFNG	☆	●		●			40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TB62214AFTG	☆	●		●			40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB62215AFG	☆	●		●			40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HSOP28
TB62215AFNG	☆	●		●			40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TB62215AFTG	☆	●		●			40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB62215AHQ	-	●		●			40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HZIP25
TB62262FTAG	☆	●		●			40	1.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB62262FTG	☆	●		●			40	1.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB62269FTAG	☆	●		●			40	1.8	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN32
TB62269FTG	☆	●		●			40	1.8	●	●	●	●	●	●	●				●	●	●	●	-20 to +85℃	QFN48
TB6560AFG	-	●		●			40	2.5	●	●	●		●	●								●	-30 to +85°C	HQFP64
TB6560AFTG	-	●		●			40	2.5	●	●	●		●	●								●	-30 to +85°C	QFN48
TB6560AHQ	-	●		●			40	3.5	●	●	●		●	●								●	-30 to +85°C	HZIP25
TB67H452FTG	☆	●		●			40	3.5×2ch	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB67S215FTAG	☆	●		●			40	2.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S508FTG	☆	●		●	●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S512FTAG	☆	●		●			40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S522FTAG	☆	●		●			40	2.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TC78S122FNG	☆	●		●			40	2.0×2ch	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TC78S122FTG	☆	●		●			40	2.0×2ch	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48

（2）步进驱动IC 一产品线（CLK输入）②一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Note (1): Low voltage Detection
(2): Over Current Detection
(3): Heat Detection

Part Number		Motor Type		Interface			Maximum Ratings		Stepping Mode									Acrive Gain Control	Single Power Supply	Protection			Temp. Range T_A	Package
		Bipolar	Unipolar	Clock	Phase	Serial	Voltage [V]	Current [A]	Constant Current Cont.	Full	Half	1/4	1/8	1/16	1/32	1/64	1/128			UVLO (1)	ISD (2)	TSD (3)		
TB6600FG	-	●		●			50	4.5 / 5.0	●	●	●	●	●	●					●	●	●	●	-30 to +85°C	HQFP64
TB6600HG	-	●		●			50	4.5 / 5.0	●	●	●	●	●	●					●	●	●	●	-30 to +85°C	HZIP25
TB67S102AFNG	☆	●		●			50	4.0	●	●	●	●							●	●	●	●	-20 to +85°C	HTSSOP48
TB67S102AFTG	☆	●		●			50	4.0	●	●	●	●							●	●	●	●	-20 to +85°C	QFN48
TB67S103AFTG	☆	●		●		●	50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	QFN48
TB67S109AFNG	☆	●		●			50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	HTSSOP48
TB67S109AFTG	☆	●		●			50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	QFN48
TB67S128FTG	☆	●		●			50	5.0	●	●	●	●	●	●	●	●	●	●	●	●	●	●	-40 to +85°C	QFN48
TB67S209FTG	☆	●		●			50	4.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	QFN48
TB67S249FTG	☆	●		●			50	4.5	●	●	●	●	●	●	●			●	●	●	●	●	-20 to +85°C	QFN48
TB67S269FTG	☆	●		●			50	2.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	QFN48
TB67S279FTG	☆	●		●			50	2.0	●	●	●	●	●	●	●			●	●	●	●	●	-20 to +85°C	QFN48
TB67S289FTG	☆	●		●			50	3.0	●	●	●	●	●	●	●			●	●	●	●	●	-20 to +85°C	QFN48
TB67S580FNG	** ☆	●		●			50	1.6	●	●	●	●	●	●	●				●	●	●	●	-40 to +85°C	HTSSOP28
TB67S581FNG	** ☆	●		●			50	2.5	●	●	●	●	●	●	●				●	●	●	●	-40 to +85°C	HTSSOP28
TB67S158FTG	☆		●	●			80	3.0×1ch		●	●								●	●	●	●	-20 to +85°C	QFN48
TB67S158FTG	☆		●	●	●	●	80	1.5×2ch		●	●								●	●	●	●	-20 to +85°C	QFN48
TB67S158NG	☆		●	●	●	●	80	1.5×2ch		●	●								●	●	●	●	-20 to +85°C	SDIP24
TB67S179FTG	☆		●	●			80	1.5	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	QFN48
TB67S142FTG	☆		●	●			84	3.0	●	●	●	●							●	●	●	●	-20 to +85°C	QFN48
TB67S142HG	-		●	●			84	3.0	●	●	●	●							●	●	●	●	-20 to +85°C	HZIP25
TB67S142NG	☆		●	●			84	3.0	●	●	●	●							●	●	●	●	-20 to +85°C	SDIP24
TB67S149FG	☆		●	●			84	3.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	HSSOP28
TB67S149FTG	☆		●	●			84	3.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	QFN48
TB67S149HG	-		●	●			84	3.0	●	●	●	●	●	●	●				●	●	●	●	-20 to +85°C	HZIP25

（2）步进驱动IC 一产品线（ Phase输入）①一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Note (1): Low voltage Detection
(2): Over Current Detection
(3): Heat Detection

Part Number		Motor Type		Interface			Maximum Ratings		Stepping Mode									Acrive Gain Control	Single Power Supply	Protection			Temp. Range T_A	Package
		Bipolar	Unipolar	Clock	Phase	Serial	Voltage [V]	Current [A]	Constant Current Cont.	Full	Half	1/4	1/8	1/16	1/32	1/64	1/128			UVLO (1)	ISD (2)	TSD (3)		
TC78H651AFNG	☆	●			●		8	2.0		●	●								●	●	●	●	-40 to +105°C	TSSOP16
TC78H653FTG	☆	●			●		8	2.0		●	●								●	●	●	●	-40 to +105°C	QFN16
TC78H611FNG	☆	●			●		18	1.1		●	●									●	●	●	-30 to +85°C	TSSOP16
TC78H621FNG	☆	●			●		18	1.1		●	●									●	●	●	-30 to +85°C	TSSOP16
TC78H660FNG	** ☆	●			●		18	2.0	●	●	●								●	●	●	●	-40 to +85℃	TSSOP16
TC78H660FTG	** ☆	●			●		18	2.0	●	●	●								●	●	●	●	-40 to +85℃	QFN16
TB6674FAG	-	●			●		24	0.2		●										●	●	●	-30 to +85°C	SSOP16
TB6674FG	-	●			●		24	0.4		●										●	●	●	-30 to +85°C	HSOP16
TB6674PG	-	●			●		24	0.4		●										●	●	●	-30 to +85°C	DIP16
TB62208FG	☆	●			●		40	1.8	●	●	●								●	●	●	●	-20 to +85℃	HSOP28
TB62208FNG	☆	●			●		40	1.8	●	●	●								●	●	●	●	-20 to +85℃	HTSSOP48
TB62208FTG	☆	●			●		40	1.8	●	●	●								●	●	●	●	-20 to +85℃	QFN48
TB62210FNG	☆	●			●		40	1.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP24
TB62212FNG	☆	●			●		40	1.5×2ch	●	●	●								●	●	●	●	-40 to +85℃	HTSSOP48
TB62212FTAG	☆	●			●		40	1.5×2ch	●	●	●								●	●	●	●	-40 to +85℃	QFN48
TB62213AFG	☆	●			●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HSOP28
TB62213AFNG	☆	●			●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TB62213AFTG	☆	●			●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB62213AHQ	-	●			●		40	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HZIP25
TB62218AFG	☆	●			●		40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	HSOP28
TB62218AFNG	☆	●			●		40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TB62218AFTG	☆	●			●		40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB62261FTAG	☆	●			●		40	1.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB62261FTG	☆	●			●		40	1.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB6562AFG	-	●			●		40	1.5	●	●	●	●							●		●	●	-20 to +85°C	SSOP30
TB6562ANG	-	●			●		40	1.5	●	●	●	●							●		●	●	-20 to +85°C	SDIP24
TB67S213FTAG	☆	●			●		40	2.5	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S511FTAG	☆	●			●		40	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TB67S521FTAG	☆	●			●		40	2.8	●	●	●	●							●	●	●	●	-20 to +85℃	QFN36
TC78S121FNG	☆	●			●		40	2.0×2ch	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TC78S121FTG	☆	●			●		40	2.0×2ch	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48

（2）步进驱动IC 一产品线（ Phase输入）②一

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Note (1): Low voltage Detection
(2): Over Current Detection
(3): Heat Detection

Part Number		Motor Type		Interface			Maximum Ratings		Stepping Mode									Acrive Gain Control	Single Power Supply	Protection			Temp. Range T_A	Package
		Bipolar	Unipolar	Clock	Phase	Serial	Voltage [V]	Current [A]	Constant Current Cont.	Full	Half	1/4	1/8	1/16	1/32	1/64	1/128			UVLO (1)	ISD (2)	TSD (3)		
TB67S101AFNG	☆	●			●		50	4.0	●	●	●	●							●	●	●	●	-20 to +85℃	HTSSOP48
TB67S101AFTG	☆	●			●		50	4.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB67S101ANG	-	●			●		50	4.0	●	●	●	●							●	●	●	●	-20 to +85℃	SDIP24
TB67S105FTG	☆	●				●	50	3.0	●	●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S261FTG	☆	●			●		50	2.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB67S265FTG	☆	●				●	50	2.0	●	●	●								●	●	●	●	-20 to +85℃	QFN48
TB67S285FTG	☆	●				●	50	3.0	●	●	●							●	●	●	●	●	-20 to +85℃	QFN48
TB67S111PG	☆		●				80	1.5		●	●								●	●	●	●	-20 to +85℃	DIP16
TB67S158NG	-		●		●	●	80	1.5×2ch		●	●								●	●	●	●	-20 to +85℃	SDIP24
TB67S141FTG	☆		●		●		84	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	QFN48
TB67S141HG	-		●		●		84	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	HZIP25
TB67S141NG	☆		●		●		84	3.0	●	●	●	●							●	●	●	●	-20 to +85℃	SDIP24
TB67S145FTG	☆		●			●	84	3.0	●	●	●								●	●	●	●	-20 to +85℃	QFN48

（3） BDC电机驱动IC 一产品线①一

Note (1): Low voltage Detection
(2): Over Current Detection
(3): Heat Detection
(4): Large Mode
○:Latch type
◊:Non latch type

++ Under Planning
** Under Development
* New Item
☆ Moisture-proof pack product

Part Number		Large Mode	Maximum Ratings		Output Ron	Circuits (Ch)	C.C. PWM	Single Power Supply	Protection			Temp. Range T_A	Package
			Voltage [V]	Current [A]					UVLO (1)	ISD (2)	TSD (3)		
TB6613FTG	☆		6	0.8	1.50	8	●		●		◊	-20 to +85°C	QON44
TC78H651AFNG	☆		8	2.0	0.22	2		●	●	○	◊	-40 to +105°C	TSSOP16
TC78H653FTG	☆	●	8	2.0 / 4.0(4)	0.22 / 0.11(4)	2 / 1(4)		●	●	○	◊	-40 to +105°C	QFN16
TB6552FNG	☆		15	1.0	1.50	2					◊	-20 to +85°C	SSOP16
TB6552FTG	☆		15	1.0	1.50	2					◊	-20 to +85°C	QFN16
TB6612FNG	☆		15	3.2	0.50	2			●		◊	-20 to +85°C	SSOP24
TC78H600FNG	☆		18	1.0	1.20	2	●		●	○	◊	-20 to +85°C	SSOP20
TC78H600FTG	-		18	1.0	1.20	2	●		●	○	◊	-20 to +85°C	QFN24
TC78H610FNG	☆		18	1.0	1.20	2			●	○	◊	-20 to +85°C	SSOP16
TC78H611FNG	☆		18	1.1	0.80	2			●	○	◊	-30 to +85°C	TSSOP16
TC78H620FNG	☆		18	1.0	1.20	2			●	○	◊	-20 to +85°C	SSOP16
TC78H621FNG	☆		18	1.1	0.80	2			●	○	◊	-30 to +85°C	TSSOP16
TC78H630FNG	☆		18	2.1	0.40	1			●	○	◊	-30 to +85°C	TSSOP16
TC78H660FNG	☆		18	2.0	0.48	2	●	●	●	○	○	-40 to +85°C	TSSOP16
TC78H660FTG	☆		18	2.0	0.48	2	●	●	●	○	○	-40 to +85°C	QFN16
TB62212FNG	☆	●	40	2.0 / 4.0(4)	2.20 / 1.10(4)	4 / 2(4)	●	●	●	○	○	-40 to +85℃	HTSSOP48
TB62212FTAG	☆	●	40	2.0 / 4.0(4)	2.20 / 1.10(4)	4 / 2(4)	●	●	●	○	○	-40 to +85℃	QFN48
TB62216FG	☆		40	2.5	1.00	2	●	●	●	○	○	-20 to +85°C	HSOP28
TB62216FNG	☆		40	2.5	1.00	2	●	●	●	○	○	-20 to +85°C	HTSSOP48
TB62216FTG	☆		40	2.5	1.00	2	●	●	●	○	○	-20 to +85°C	QFN48
TB6561FG	-		40	1.5	1.50	2		●		◊	◊	-20 to +85°C	SSOP30
TB6561NG	-		40	1.5	1.50	2		●		◊	◊	-20 to +85°C	SDIP24
TB6640AFTG	☆		40	3.0	1.00	1	●		●	○/◊	○/◊	-40 to +85°C	QFN48
TB6640FTG	☆		40	3.0	1.00	1	●		●	○/◊	○/◊	-40 to +85°C	QFN48
TB67H301FTG	-		40	3.0	1.00	1	●		●	○/◊	○/◊	-40 to +85°C	QFN24
TB67H452FTG	☆	●	40	3.5 / 5.0(4)	0.60 / 0.30(4)	4 / 2(4)	●	●	●	○	○	-20 to +85°C	QFN48
TC78S121FNG	☆	●	40	3.5 / 5.0(1)	0.60 / 0.30(4)	4 / 2(4)	●	●	●	○	○	-20 to +85°C	HTSSOP48
TC78S121FTG	☆	●	40	3.5 / 5.0(1)	0.60 / 0.30(4)	4 / 2(4)	●	●	●	○	○	-20 to +85°C	QFN48
TC78S122FNG	☆	●	40	3.5 / 5.0(1)	0.60 / 0.30(4)	4 / 2(4)	●	●	●	○	○	-20 to +85°C	HTSSOP48
TC78S122FTG	☆	●	40	3.5 / 5.0(1)	0.60 / 0.30(4)	4 / 2(4)	●	●	●	○	○	-20 to +85°C	QFN48

（3） BDC电机驱动IC 一产品线②一

Note (1): Low voltage Detection
(2): Over Current Detection
(3): Heat Detection
(4): Large Mode
○:Latch type
◊:Non latch type

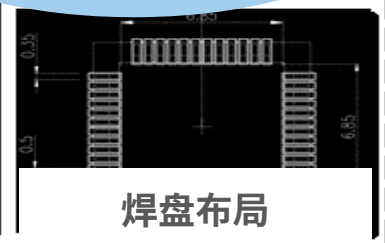
Part Number	++ Under Planning ** Under Development * New Item ☆ Moisture-proof pack product		Large Mode	Maximum Ratings		Output Ron	Circuits (Ch)	C.C. PWM	Single Power Supply	Protection			Temp. Range T_A	Package
				Voltage [V]	Current [A]					UVLO (1)	ISD (2)	TSD (3)		
TB6559FG		-		50	2.5	1.30	1	●	●		◊	◊	-30 to +85°C	HSOP16
TB6568KQ		-		50	3.0	0.55	1		●	●	○	○	-40 to +85°C	HSIP7
TB6569FG		-		50	4.5	0.55	1	●	●	●	○	○	-40 to +85°C	HSOP16
TB6569FTG		☆		50	4.5	0.55	1	●	●	●	○	○	-40 to +85°C	QFN32
TB6641FG		-		50	4.5	0.55	1	●	●	●	○	○	-40 to +85°C	HSOP16
TB6641FTG		☆		50	4.5	0.55	1	●	●	●	○	○	-40 to +85°C	QFN32
TB6642FG		-		50	4.5	0.55	1		●	●	○/◊	○/◊	-40 to +85°C	HSOP16
TB6642FTG		☆		50	4.5	0.55	1		●	●	○/◊	○/◊	-40 to +85°C	QFN32
TB6643KQ		-		50	4.5	0.55	1		●	●	○	○	-40 to +85°C	HSIP7
TB67H302HG		-		50	5.0	0.40	2	●	●	●	○	○	-30 to +85°C	HZIP25
TB67H303HG		-		50	10.0	0.20	1	●	●	●	○	○	-30 to +85°C	HZIP25
TB67H400AFNG		☆	●	50	4.0 / 8.0(4)	0.49 / 0.25(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	HTSSOP48
TB67H400AFTG		☆	●	50	4.0 / 8.0(4)	0.49 / 0.25(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	QFN48
TB67H400AHG		-	●	50	4.0 / 8.0(4)	0.49 / 0.25(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	HZIP25
TB67H400ANG		-	●	50	4.0 / 8.0(4)	0.49 / 0.25(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	SDIP24
TB67H401FTG		☆	●	50	3.0 / 6.0(4)	0.49 / 0.245(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	QFN48
TB67H410FTG		☆	●	50	2.5 / 5.0(4)	0.80 / 0.40(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	QFN48
TB67H410NG		☆	●	50	2.5 / 5.0(4)	0.80 / 0.40(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	SDIP24
TB67H420FTG		☆	●	50	4.5 / 9.0(4)	0.33 / 0.17(4)	2 / 1(4)	●	●	●	○	○	-20 to +85°C	QFN48
TB67H450FNG	*	☆		50	3.5	0.60	1	●	●	●	○	◊	-40 to +85°C	SSOP8
TB67H451FNG	*	☆		50	3.5	0.60	1	●	●	●	◊	◊	-40 to +85°C	SSOP8
TB67H480FNG	**	☆		50	2.5	0.40	2	●	●	●	○	◊	-40 to +85°C	HTSSOP28
TB67H481FNG	**	☆		50	2.5	0.40	2	●	●	●	○	◊	-40 to +85°C	HTSSOP28

Web支持内容

技术文档

规格书

应用手册

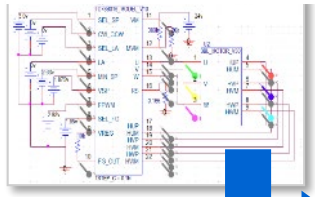

焊盘布局

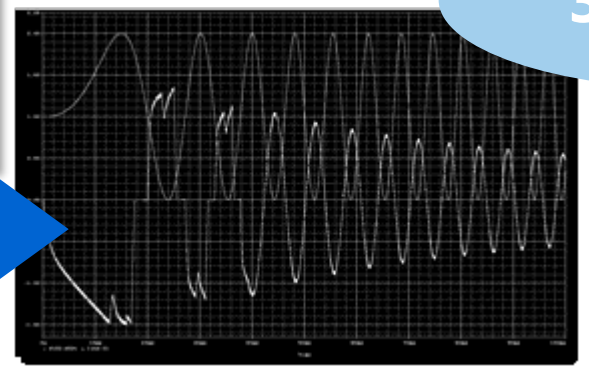
172种产品

每种产品的文档都可以通过我们的网站获得.

开发支持

PSpice model





30种模型

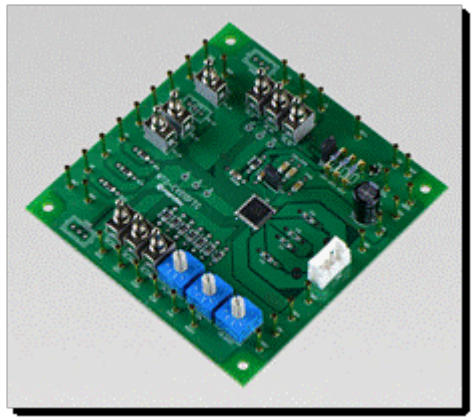
PSPICE models are also available through our web site.

官网现已提供技术支持视频

在视频中介绍独特的电机控制技术。

- Intelligent Phase Control
- AGC
- ADMD
- ACDS

评估板



第三方EVB
在Digikey／Marutsu网站上提供

<16 products>

<40 products>


TOSHIBA

To Audiences

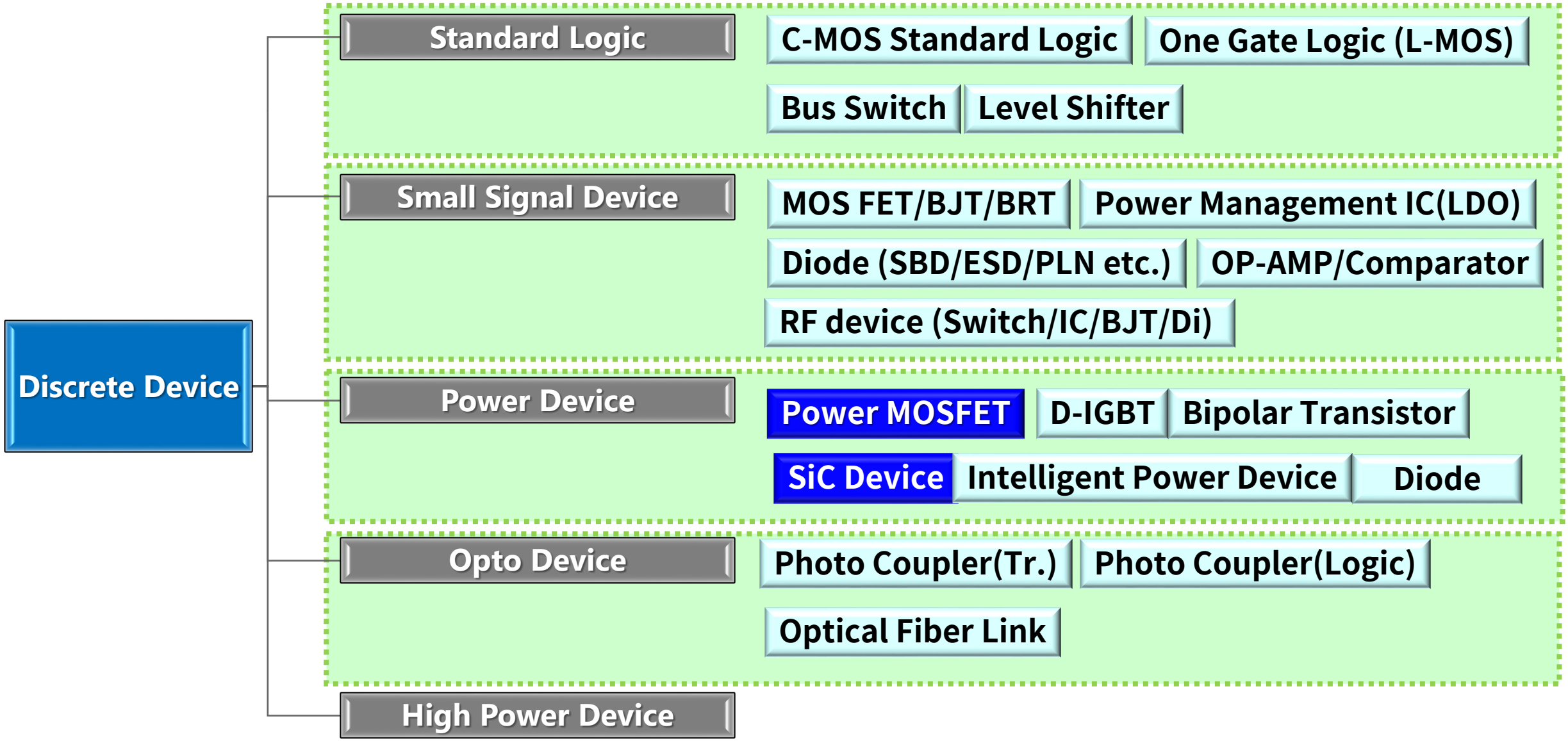
东芝功率分立器件

TOSHIBA

Toshiba Devices & Storage (Shanghai) Co., Ltd.

2020.06.19

东芝分立器件


Discrete Device
Standard Logic
C-MOS Standard Logic
One Gate Logic (L-MOS)
Bus Switch
Level Shifter
Small Signal Device
MOS FET/BJT/BRT
Power Management IC(LDO)
Diode (SBD/ESD/PLN etc.)
OP-AMP/Comparator
RF device (Switch/IC/BJT/Di)
Power Device
Power MOSFET
D-IGBT
Bipolar Transistor
SiC Device
Intelligent Power Device
Diode
Opto Device
Photo Coupler(Tr.)
Photo Coupler(Logic)
Optical Fiber Link
High Power Device

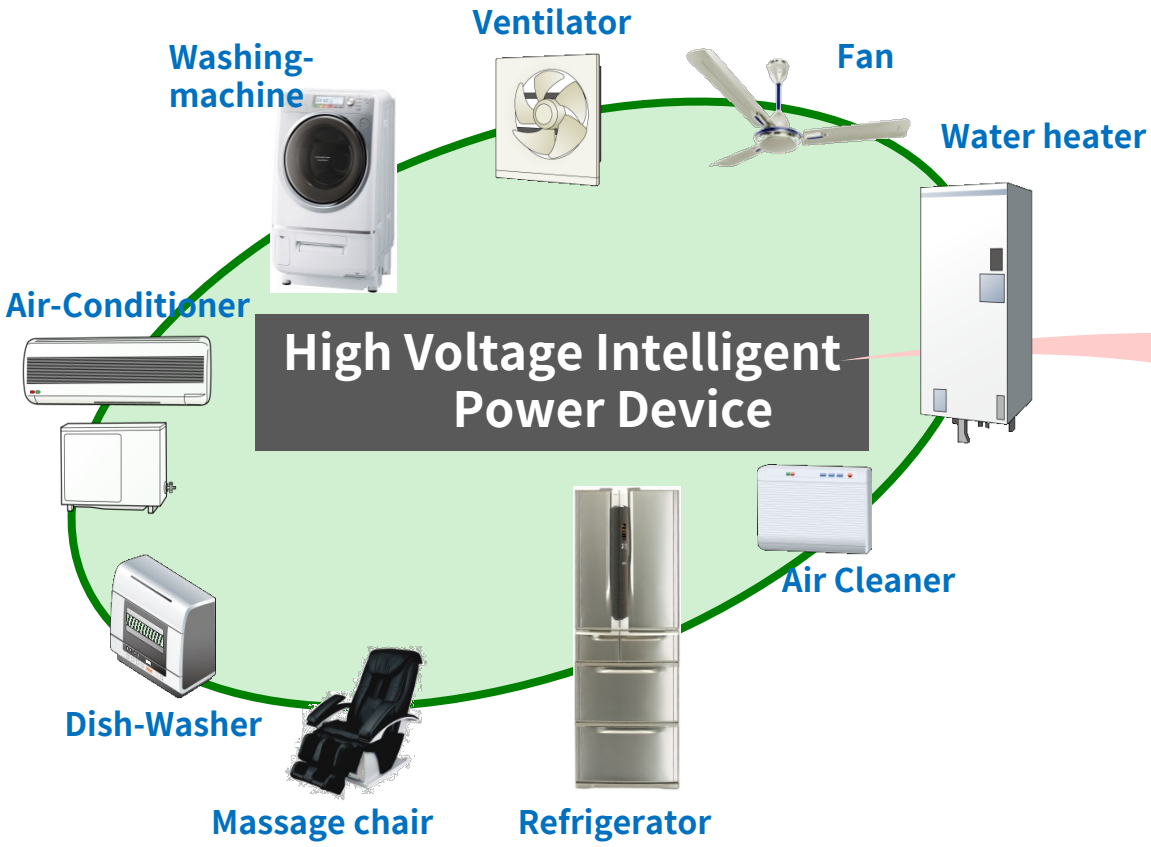
Contents

01-a

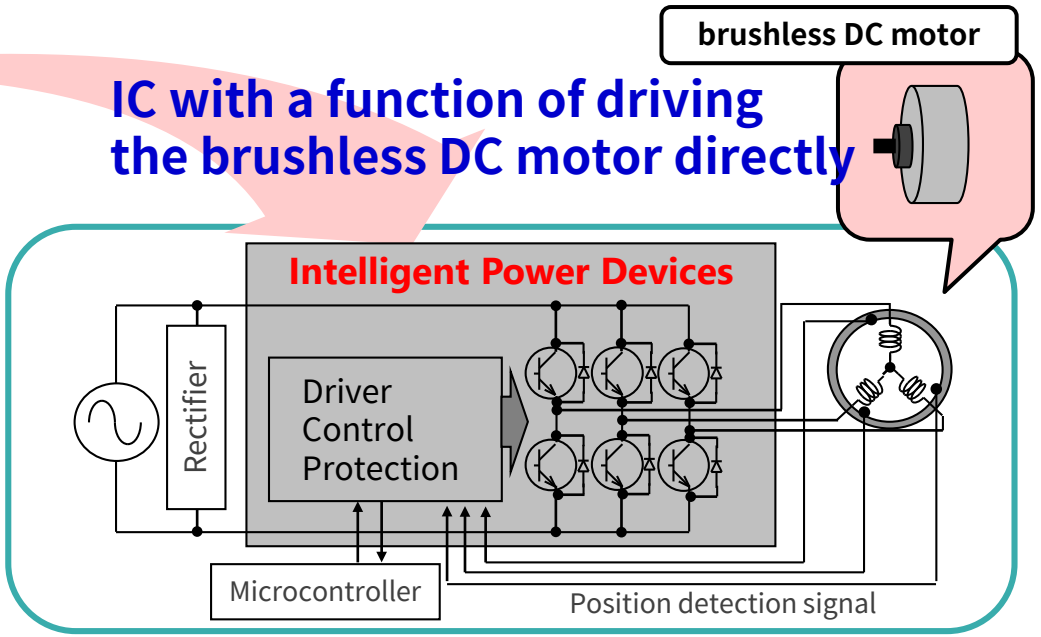
高压智能功率器件

HVIPD的应用领域

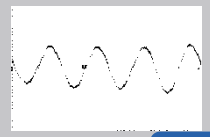
HVIPD已应用于许多小型BLDC电机应用中，如变频空调、洗碗机、洗衣机等。



>Maximum rating
Voltage：600V/500V/250V
Current：0.7A～3A



用于小型电机驱动的HVIPD产品线

type	Product name	Rating	Function						Package
			Hall Sensor input	Forward/Reverse selection pin <FR>	Rotation pulse selection pin <FGC>	Over current	Over temp	Under voltage	
Square wave type (120°)  * : Under development	TPD4151K/F	250V/1A	✔	✔	–	✔	✔	✔	DIP26/ HSSOP31
	TPD4142K	500V/1A	✔	✔	–	✔	✔	✔	DIP26
	TPD4146K		✔	–	✔	✔	✔	✔	
	TPD4152F TPD4162F*	600V/(0.7)A	✔	✔	–	✔	✔	✔	HSSOP31
Sine Wave type (180°) 	TPD4123K	500V/1A	–	–	–	✔	✔	✔	DIP26
	TPD4123AK		–	–	–	–	✔	✔	
	TPD4144K	500V/2A	–	–	–	✔	✔	✔	
	TPD4144AK		–	–	–	–	✔	✔	
	TPD4135K	500V/3A	–	–	–	✔	✔	✔	
	TPD4135AK		–	–	–	–	✔	✔	
Planning	TPD4164F*	600V/(2)A	–	–	–	✔	✔	✔	HSSOP31
New	TPD4204F	600V/2.5A	–	–	–	✔	✔	✔	SSOP30
New	TPD4206F	500V/2.5A	–	–	–	✔	✔	✔	
New	TPD4207F	600V/5.0A	–	–	–	✔	✔	✔	

01-b

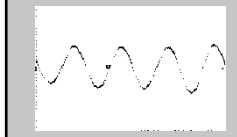
高压智能功率器件

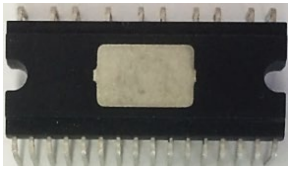
正弦波控制型

正弦波控制型HVIPD产品线

东芝切换至SMD类型

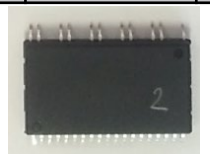
type	Product name	Rating	Function						Package
			Hall Sensor input	Forward/Reverse selection pin <FR>	Rotation pulse selection pin <FGC>	Over current	Over temp	Under voltage	
Sine Wave type (180°)	TPD4123K	500V/1A	–	–	–	✔	✔	✔	DIP26
	TPD4123AK		–	–	–	–	✔	✔	
	TPD4144K	500V/2A	–	–	–	✔	✔	✔	
	TPD4144AK		–	–	–	–	✔	✔	
	TPD4135K	500V/3A	–	–	–	✔	✔	✔	
	TPD4135AK		–	–	–	–	✔	✔	
	Planning *TPD4164F	600V/2A	–	–	–	✔	✔	✔	HSSOP31
	New TPD4204F	600V/2.5A	–	–	–	✔	✔	✔	SSOP30
	New TPD4206F	500V/2.5A	–	–	–	✔	✔	✔	
	New TPD4207F	600V/5.0A	–	–	–	✔	✔	✔	



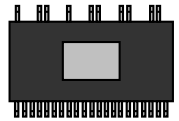


DIP26 : 32mm×13mm×3.6mm

Small:53%
Thin:56%



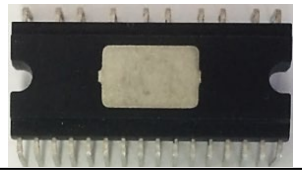
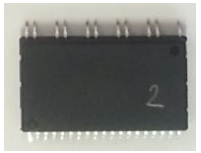
SSOP30 : 20mm×11mm×2mm



HSSOP31 : 17.5mm×8.4mm×2mm

带MOSFET模块的正弦波型

■ MOSFET achieve lower power loss than single chip solution with IGBT ⇒ MOSFET multi module
■ SMD package for compact design and auto-mounting process ⇒ SSOP30 pin package

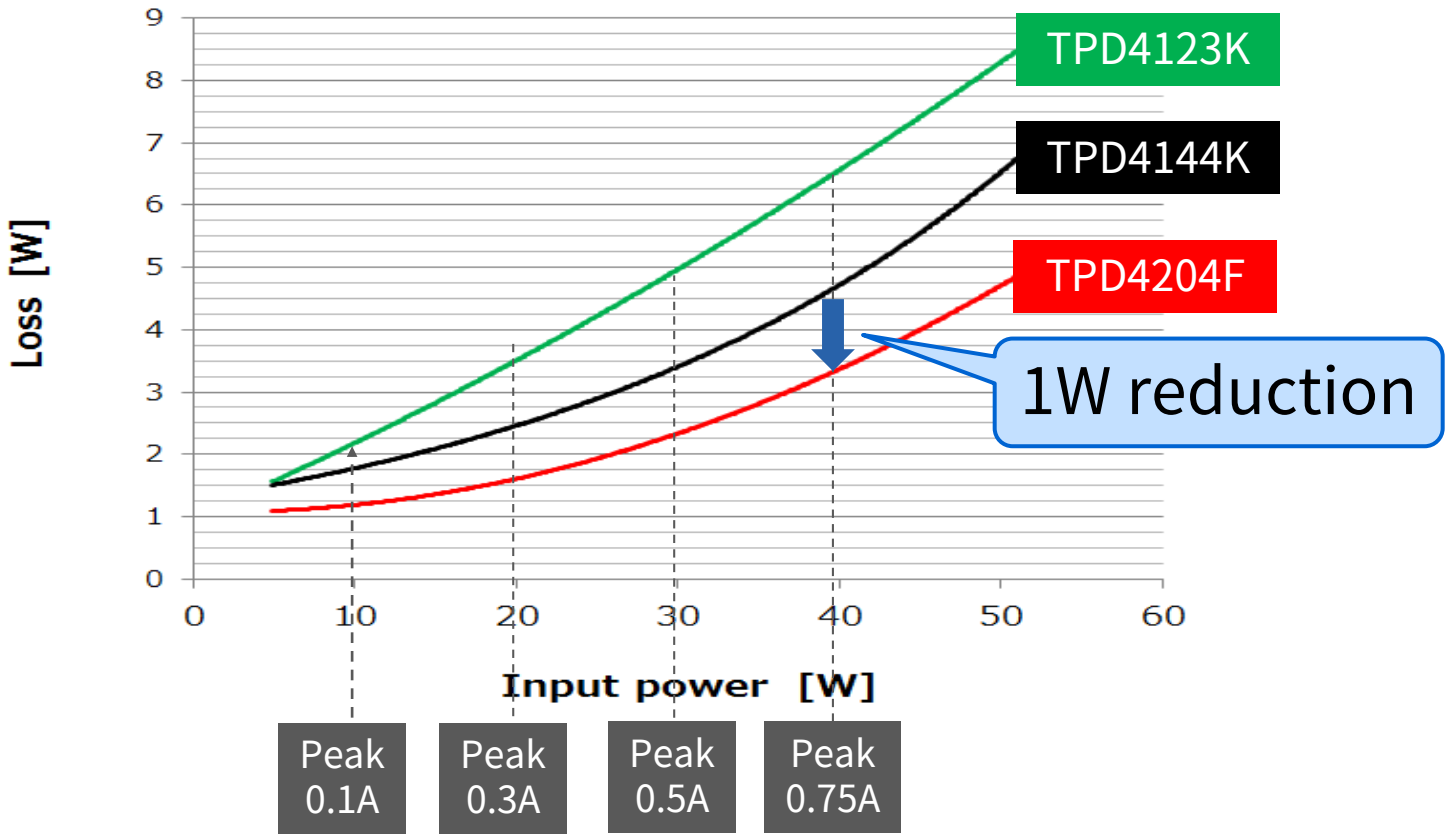
Product		Conventional product TPD4123/44K (AK)	New product **TPD4204F**
Chip structure		1chip (IGBT+FRD+Driver IC in 1chip)	Multichip (π-MOSVII HSD 6pcs and Driver IC 1pc)
Package		DIP26：32mm×13mm×3.6mm 	SSOP30：20mm×11mm×2mm Small:53% Thin:56% 
Rating	Current(DC)	1A/2A	Higher current 2.5A
	Absolute maximum voltage	500V(450V operation)	Higher voltage 600V(450V operation)
Function	Protection Main circuit	Over current (K type) Shut down function (AK type)	Over current and Shut down function
	VBS under voltage protection	Under voltage level：9V(typ.) Reverse voltage level：9.5V(typ.)	Under voltage level：10V(typ.) Reverse voltage level：10.5V(typ.)

TPD4204F与传统部件间的损耗比较

TPD4204F reduces 1W from TPD4144K (@Pin=40W)

Power loss - Input power

Condition at VBB=280V, VCC=15V, VSP=3V, fs=16.5kHz,
Controller IC：TB6551FNG,Ta=25°C, No-fan/Heat sink less



SSOP30与DIP26间的温升比较

The temp rise between DIP26 with fin and SSOP30 are same range.

Case temperature - Input power

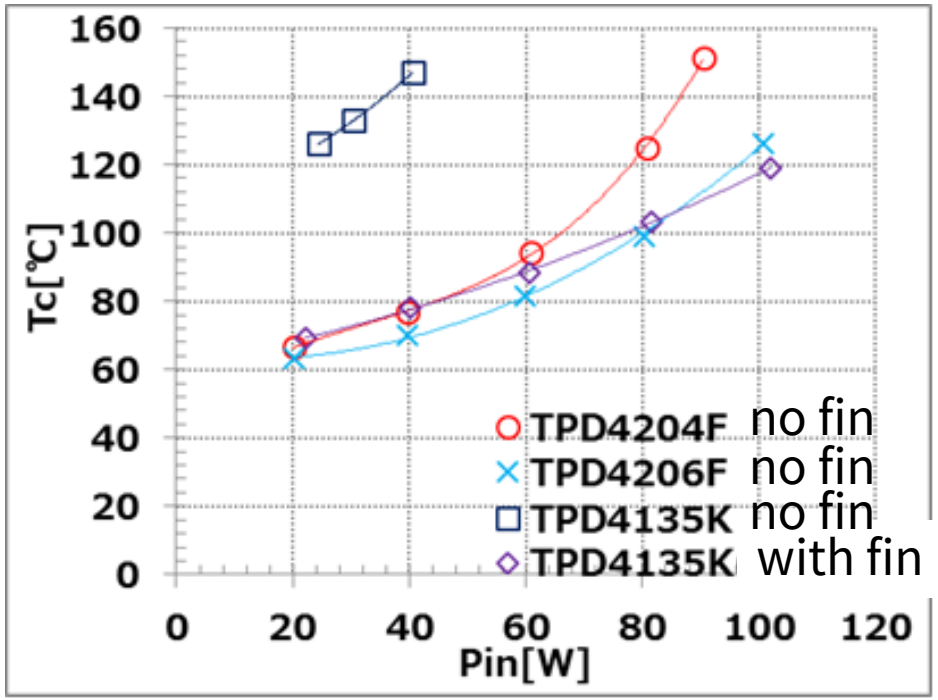
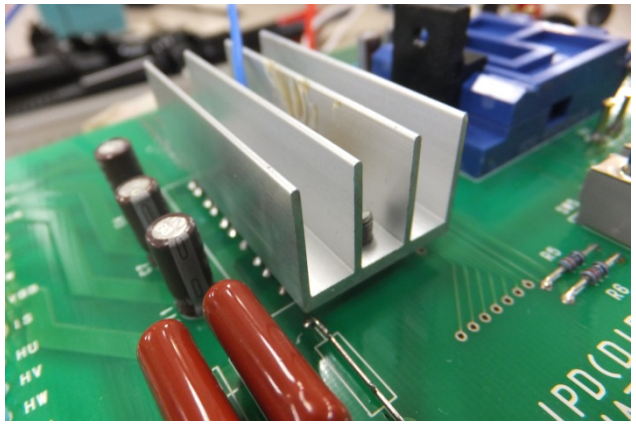
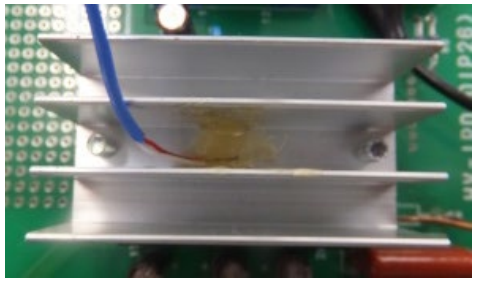


Photo of heatsink

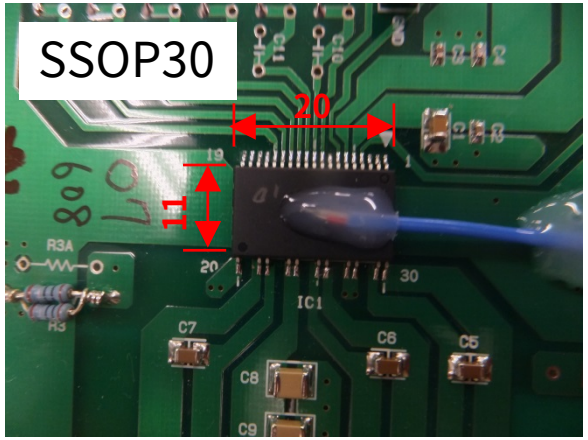


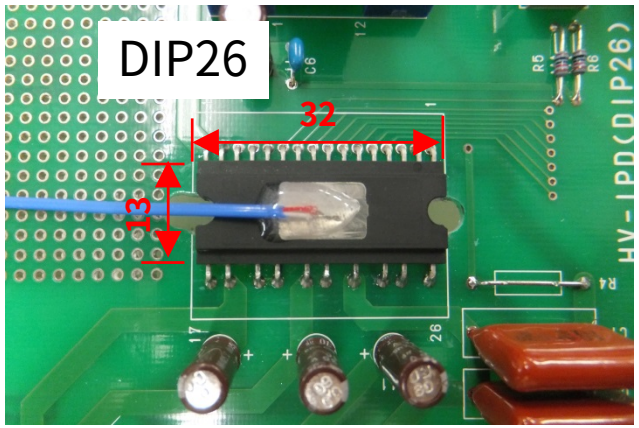
Temp measurement point



Heatsink size
21 mm x 43 mm x 15mm x 2mmt

Ref : package size comparison

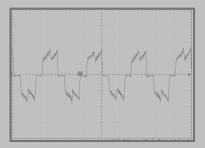




Condition at VBB=340V, VCC=15V, VSP=3V, fs=20kHz,
Controller IC：TB6551FNG,Ta=25°C

HVIPD新产品

【1】Square Wave type

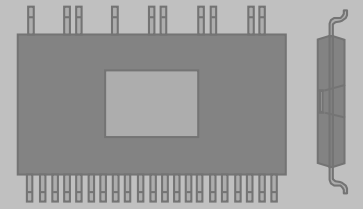


1 chip solution <IGBT type>

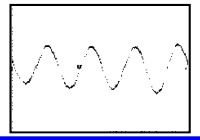
Under development

P/N	Rating	Protect function	Package
TPD4162F	600V/(0.7A)	Thermal Shutdown/Over Current/Under Voltage	HSSOP31
TPD4152F	600V/0.7A	Thermal Shutdown/Over Current/Under Voltage	HSSOP31
TPD4151F	250V/1.0A	Thermal Shutdown/Over Current/Under Voltage	HSSOP31

HSSOP31
17.5×8×2mm



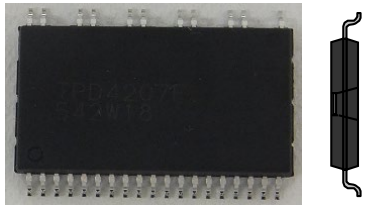
【2】Sine Wave type



Multichip solution <MOS-FET(6pcs)+Dr IC>

P/N	Rating	Protect function	Package
TPD4204F	600V/2.5A	Thermal Shutdown/Over Current/Under Voltage	SSOP30
TPD4206F	500V/2.5A	Thermal Shutdown/Over Current/Under Voltage	SSOP30
TPD4207F	600V/5.0A	Thermal Shutdown/Over Current/Under Voltage	SSOP30

SSOP30
20×11×2mm



1 chip solution <IGBT type>

Planning

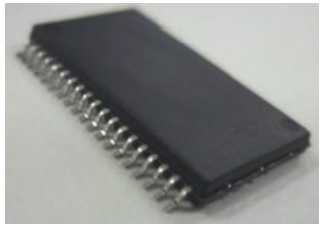
P/N	Rating	Protect function	Package
TPD4164F*	600V/2A	Thermal Shutdown/Over Current/Under Voltage	HSSOP31

TPD4204F（600V／2.5A）产品概要

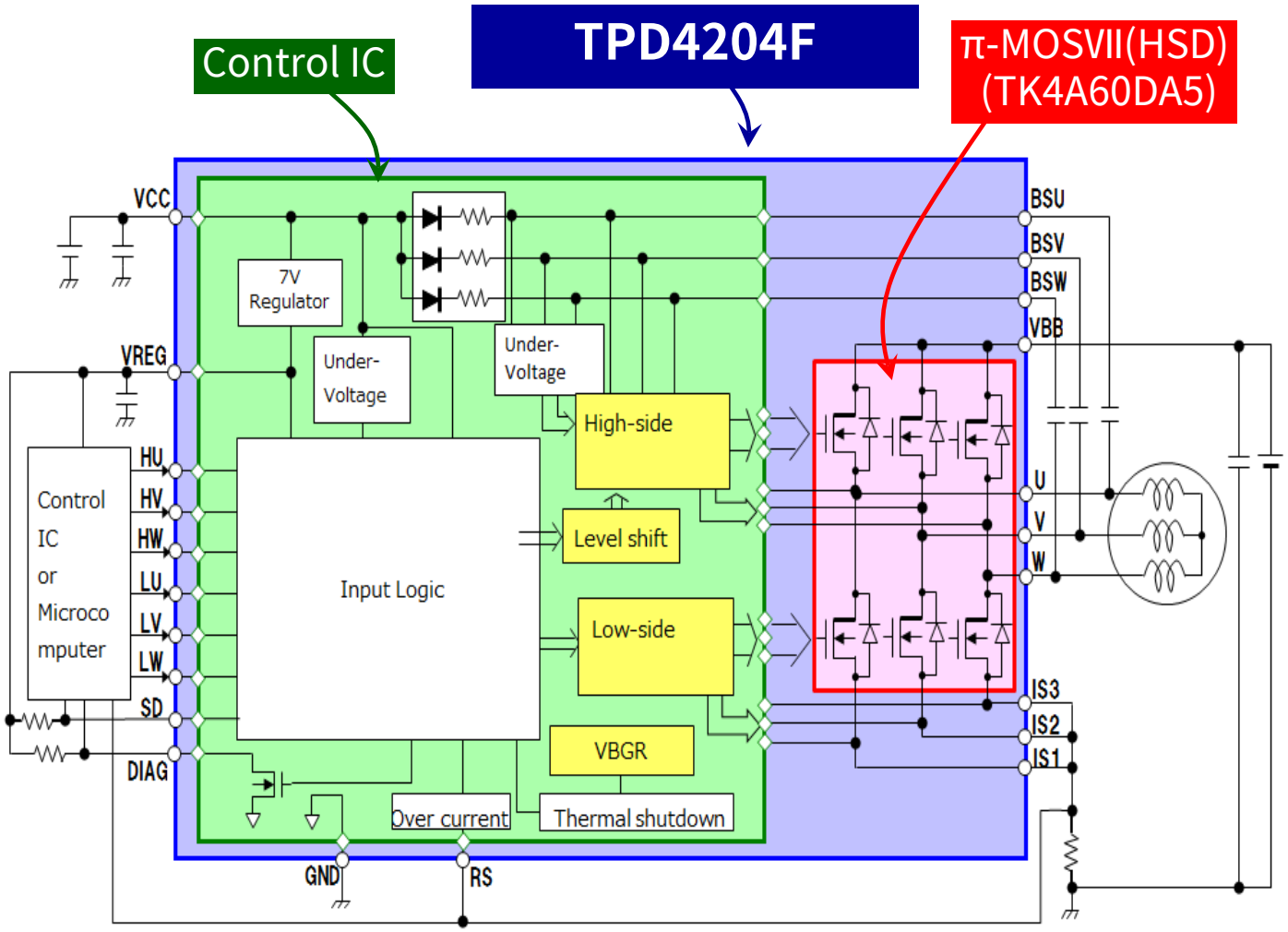
New

- Ratings:600V/2.5A
- Operating voltage:450V Max
- $R_{DS(ON)}$:2.6Ω typ.

- PKG:SSOP30
  - Control pins and high-voltage pins are separated



- Protective functions
  - Over current
  - Thermal shutdown
  - Shutdown(SD) function
  - Under voltage

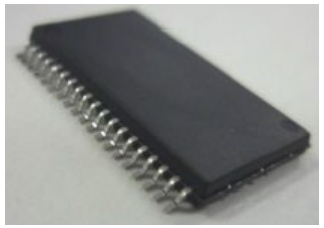


TPD4207F（600V／5A）产品概要

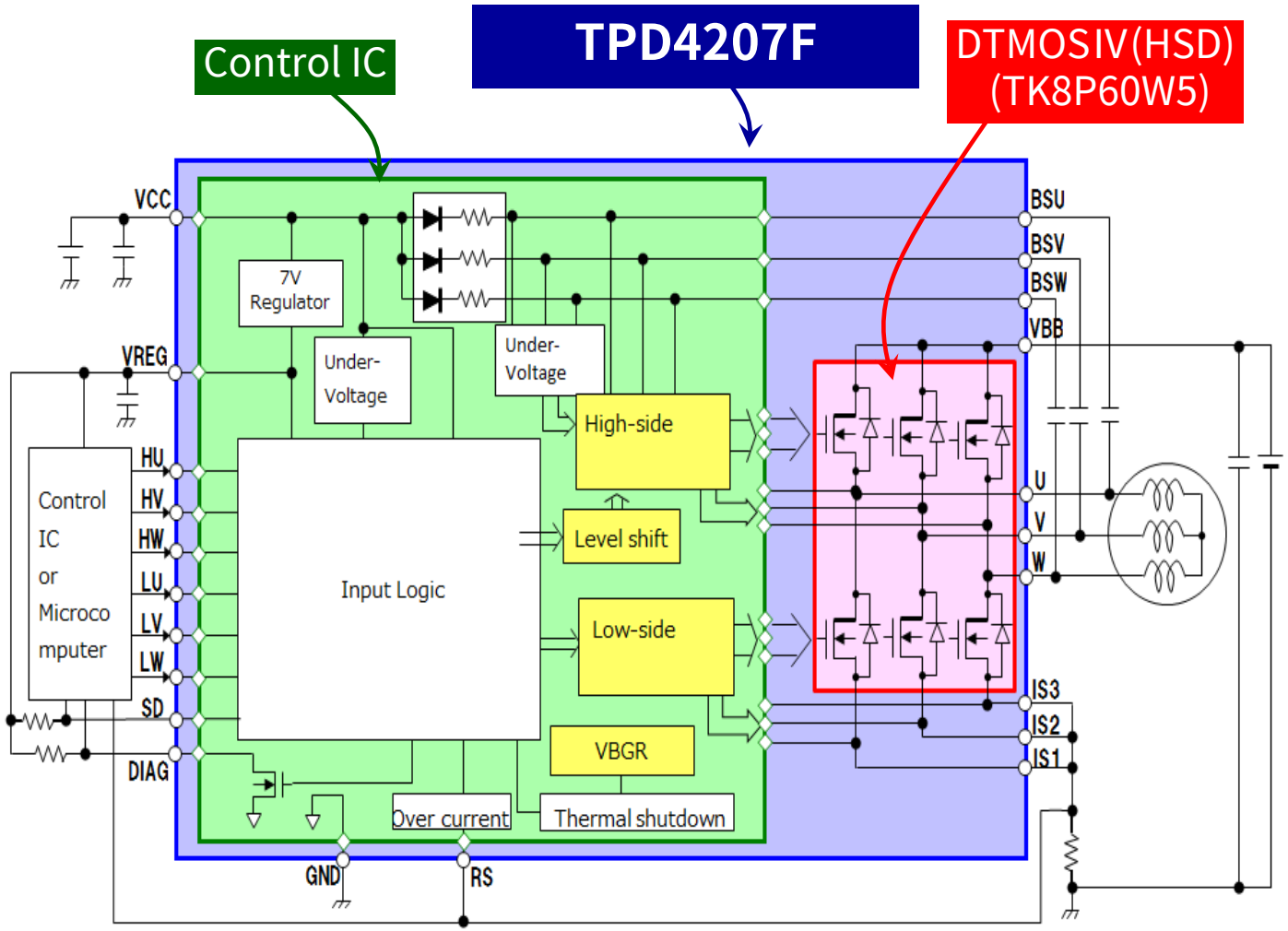
New

- Ratings:600V/5A
- Operating voltage:450V Max
- $R_{DS(ON)}$:0.44Ω typ.

- PKG:SSOP30
  - Control pins and high-voltage pins are separated

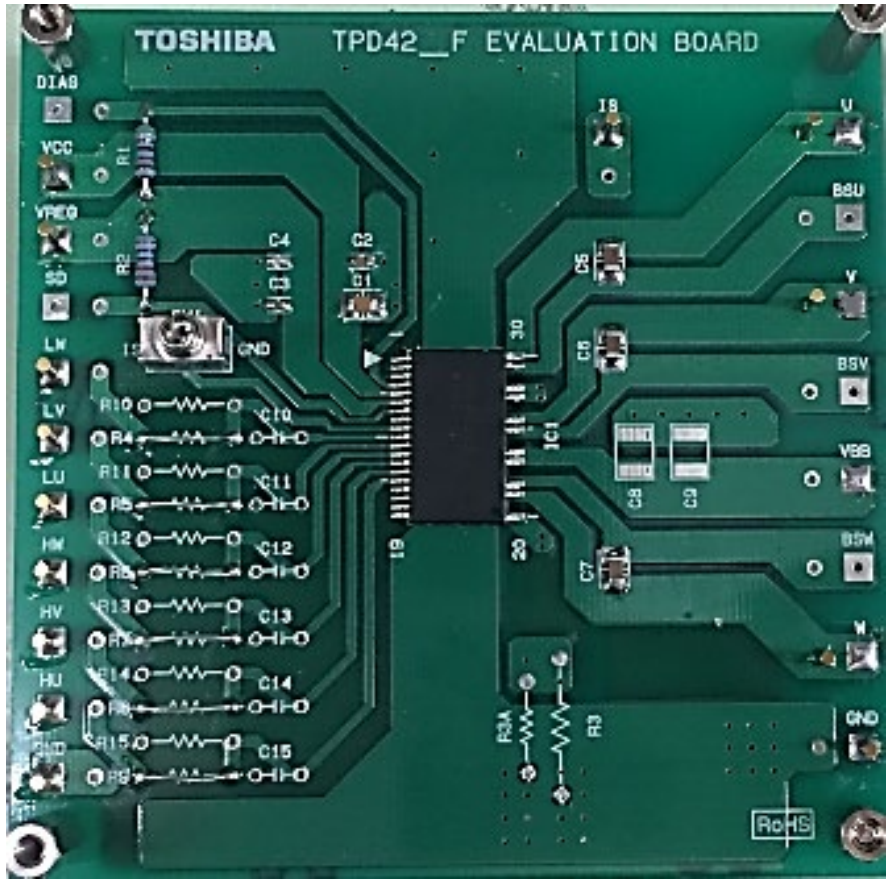


- Protective functions
  - Over current
  - Thermal shutdown
  - Shutdown(SD) function
  - Under voltage

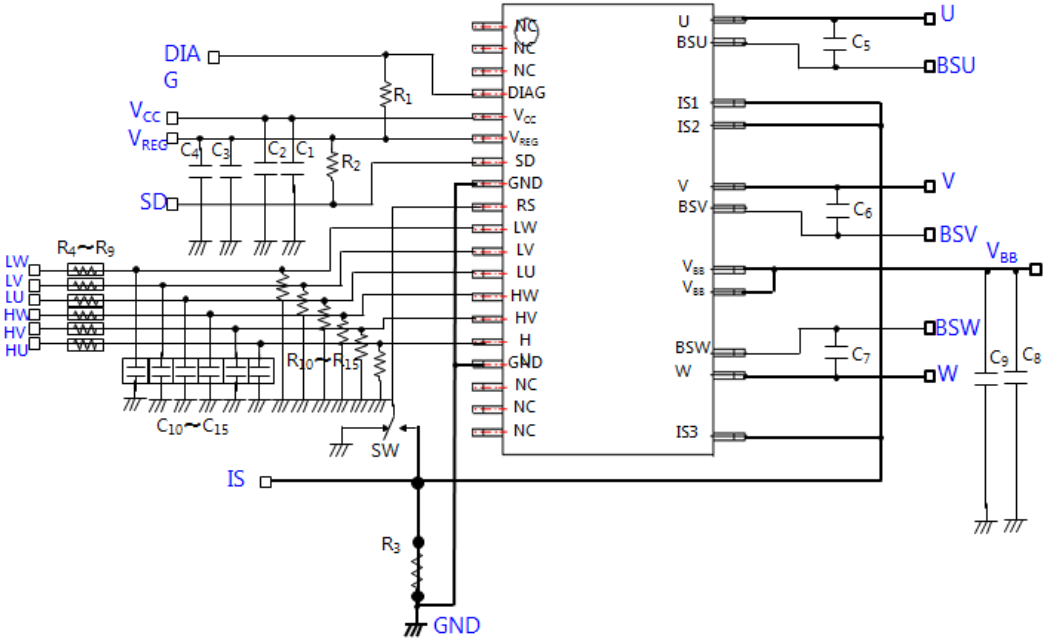


TPD420xF（SSOP30）系列评估板

●Picture of Evaluation board



●Circuit of evaluation board



●Part table

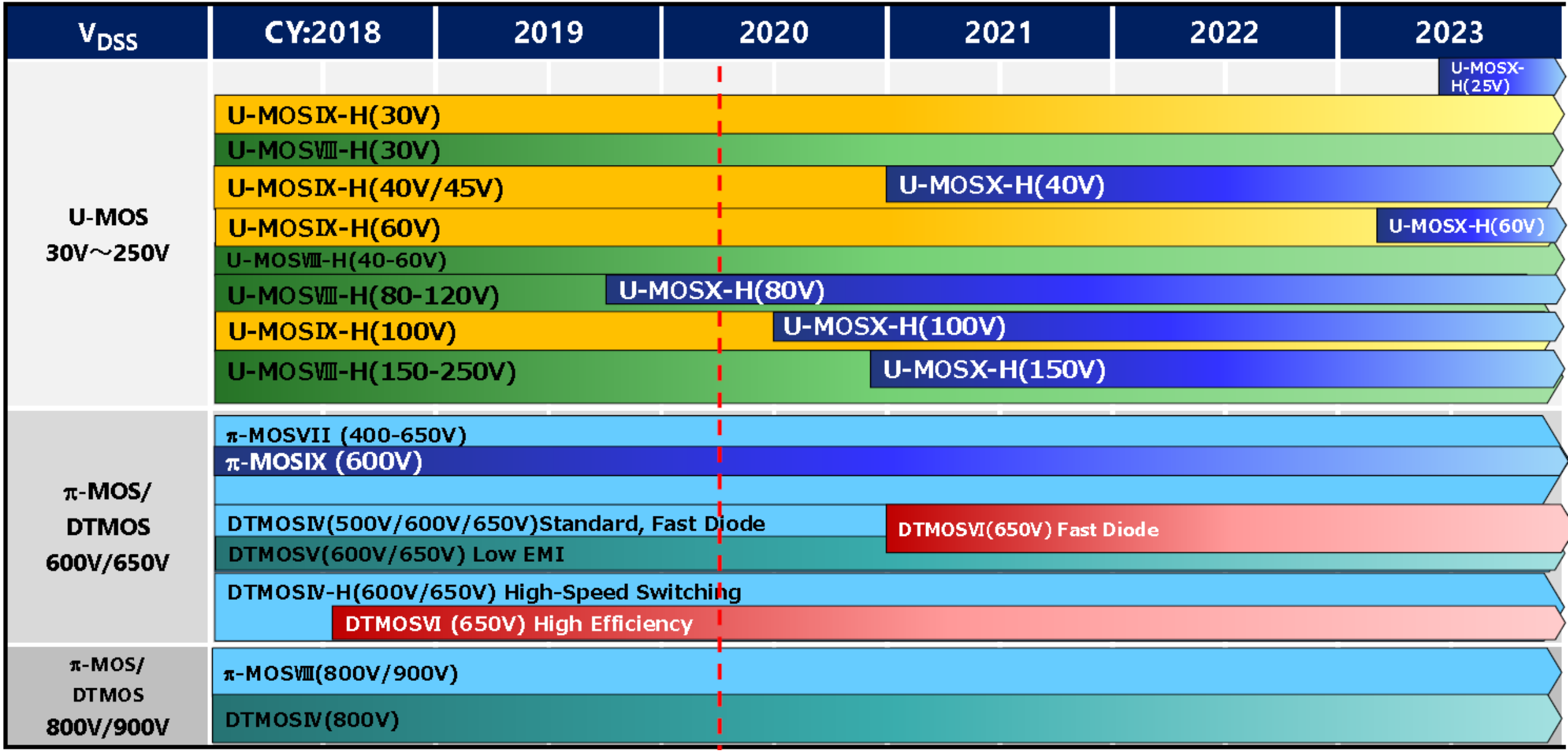
Part No.	Value
C_1	10μF/25V
C_2	0.1μF/25V
C_3	1μF/25V
C_4	1000pF/25V
C_5	2.2μF/25V
C_6	2.2μF/25V
C_7	2.2μF/25V
C_8	0.1μF/630V
C_9	0.1μF/630V
C_{10}~C_{15}	–
R_1	5.1kΩ
R_2	10kΩ
R_3	0.3Ω
R_4~R_9	Short
R_{10}~R_{15}	–

We can provide this evaluation board for your evaluation.

02

高压MOSFET

功率MOSFET（VDSS＝400~900V）设计路线图

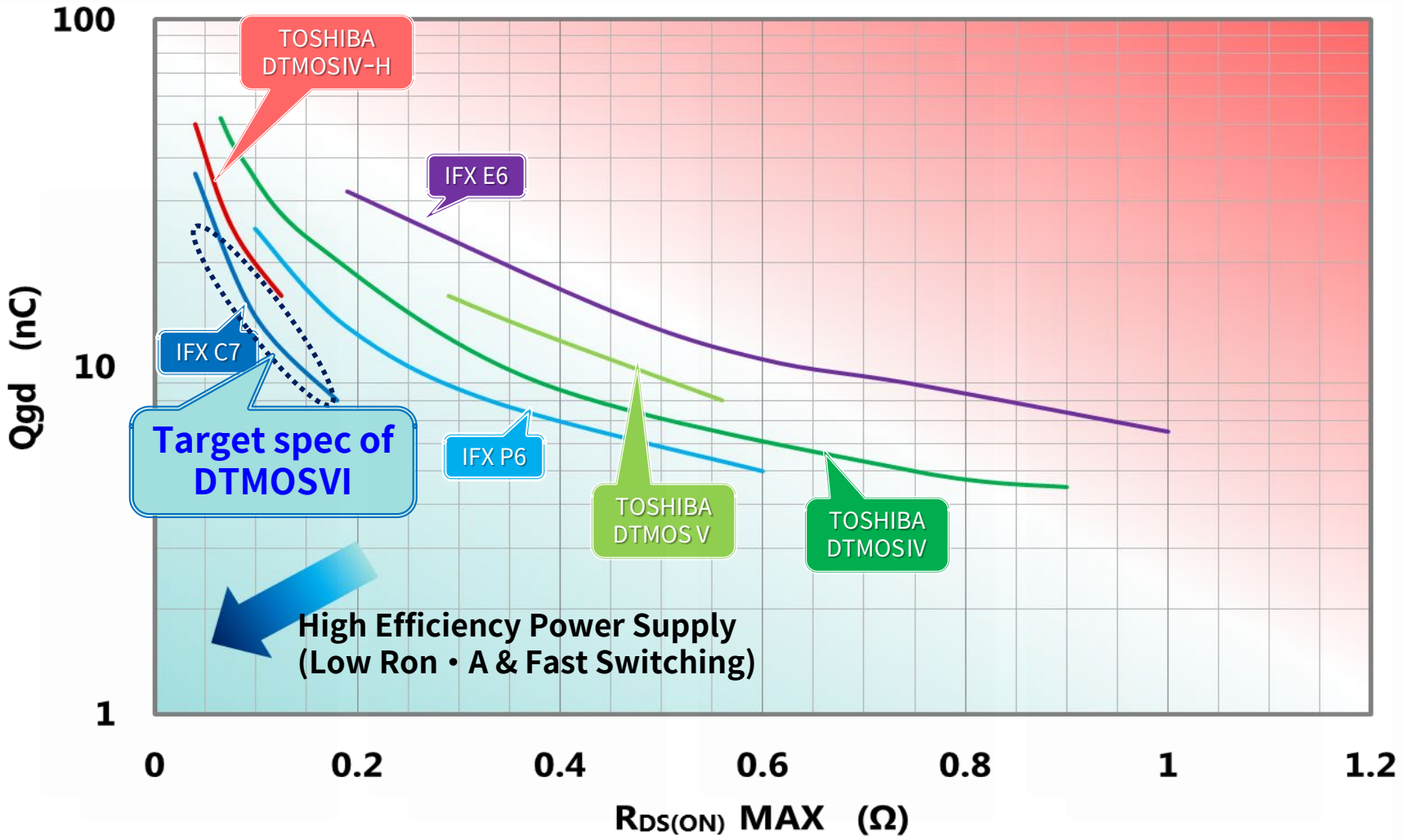


下一代超级结MOSFET

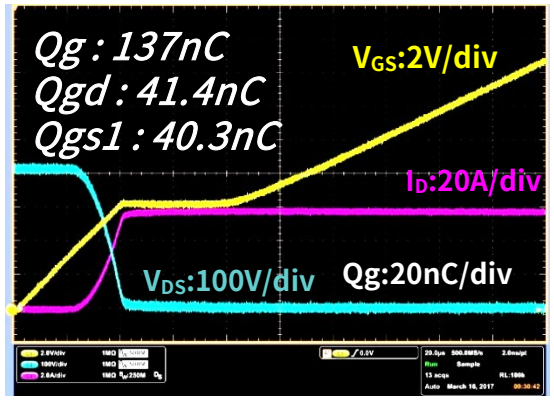
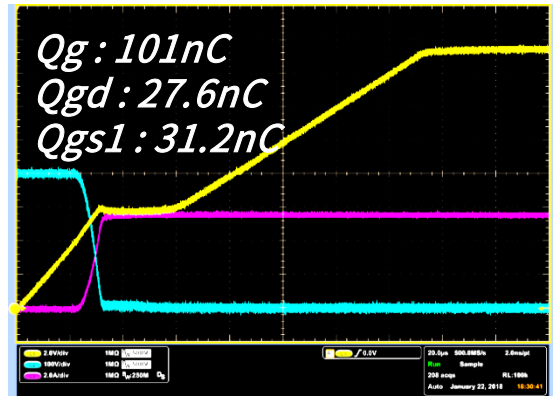
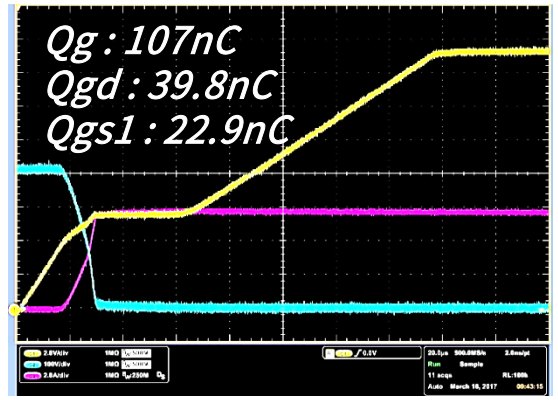
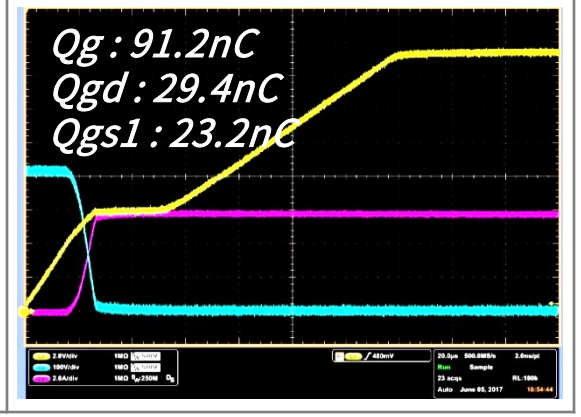
“DTMOSVI”系列

DTMOSVI系列的开发理念

DTMOSVI is targeting to catch up Ron×Qgd of Infineon C7 series



Qg特性比较

TK62N60X (600V, 40mΩ, DTMOSIV-H)	TK040N65Z (650V, 40mΩ, DTMOSVI)	IPW60R040C7 (600V, 40mΩ, Cool C7)	IPW65R045C7 (650V, 45mΩ, Cool C7)
			

Test Condition

V_{DD}≒400V

I_D=57A

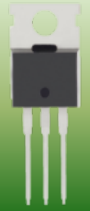
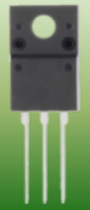
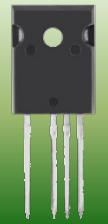
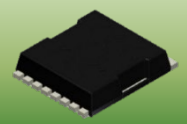
Ta=25℃

DTMOSVI has similar Qg level with Infineon’ s C7 series

DTMOSVI系列产品线与计划表

New Package

as of Mar 8, 2019
* Schedule in CY

$R_{DS(ON)}$ max (Ω)	DFN8x8	TO-220	TO-220SIS	TO-247	TO-247-4L	TOLL	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.
								
0.19 / 0.21	TK(210)V65Z ES : May./’ 19	TK190E65Z ES : 3Q/’ 19	TK190A65Z ES : Apr./’ 19			TK190U65Z	(26)	(1350)
0.155 / 0.17	TK(170)V65Z ES : May./’ 19	TK155E65Z ES : 3Q/’ 19	TK155A65Z ES : May./’ 19			TK155U65Z	(32)	(1650)
0.11 / 0.125	TK(125)V65Z ES : May./’ 19	TK110E65Z ES : 3Q/’ 19	TK110A65Z ES : May./’ 19	TK110N65Z ES : May./’ 19	TK110Z65Z ES : 2Q/’ 19	TK110U65Z	(45)	(2330)
0.090 / 0.099	TK099V65Z (0.099Ω) CS : Apr./’ 19 MP : 3Q/’ 19	TK090E65Z CS : 3Q/’ 19 MP : 4Q/’ 19	TK090A65Z MP : OK	TK090N65Z CS : OK MP : May./’ 19	TK090Z65Z MP : OK	TK090U65Z ES : OK MP : Dec.’ 19	47	2780
TBD	(TK0xxV65Z)(*1)	(TK0xxE65Z)(*1)	(TK0xxA65Z)(*1)				TBD	TBD
0.065				TK065N65Z CS : OK MP : May./’ 19	TK065Z65Z CS : OK MP : May./’ 19	TK065U65Z ES : OK MP : Dec.’ 19	62	3650
TBD						(TK0xxU65Z)(*1)	TBD	TBD
0.040				TK040N65Z MP : OK	TK040Z65Z CS : OK MP : May./’ 19		105	6250
~0.030				(TK0xxN65Z)(*1)	(TK0xxZ65Z)(*1)		TBD	TBD

Under Investigation → Making ES → ES Available(*3) → Under MP → NRND(*2)

*1 : Maximum chip size for this package. $R_{DS(ON)}$ spec will determined by achievable Ron･A.
*2 : Not Recommended for New Design
*3 : Please ask available sample qty to engineering section because sample qty is limited.
Note : Specifications and schedule of under development is just target and is subject to change without notice.

用于DTMOS系列的带开尔文源的新封装

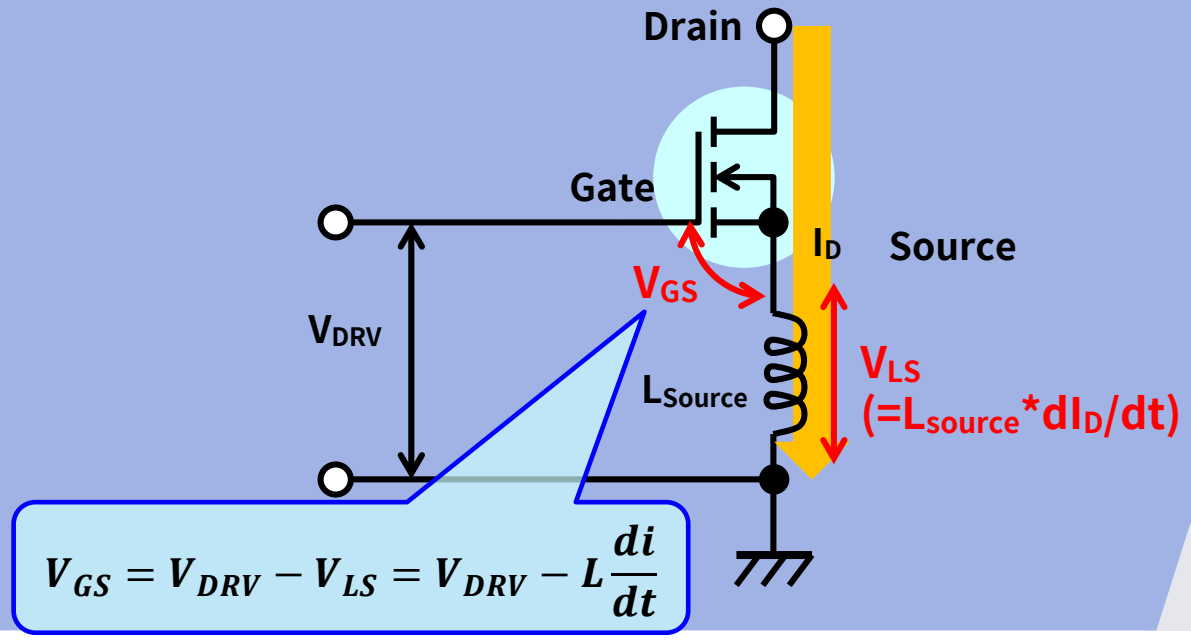
“TO-247-4L”封装

带开尔文源连接的封装优势

By excluding source inductance from driving circuit, DTMOS will show much better performance.

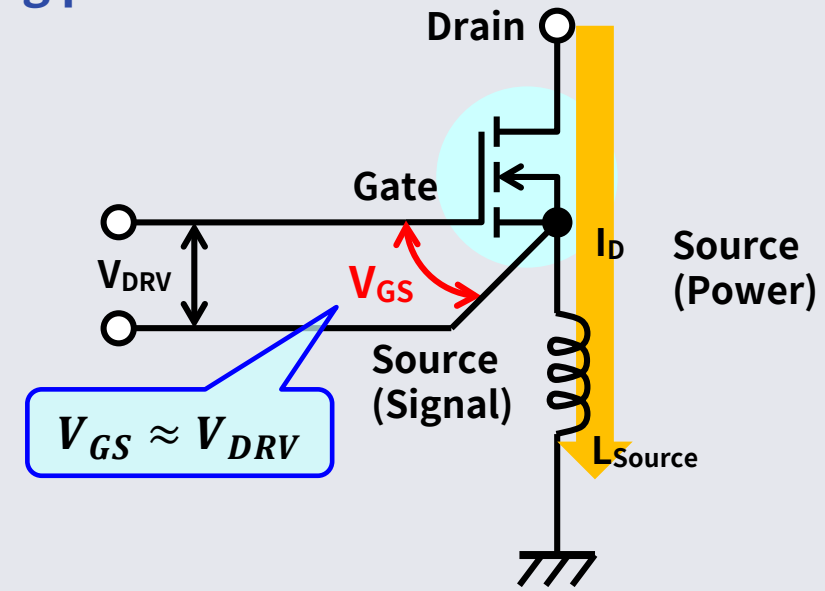
3-pin configuration

Both fast current transient and parasitic source inductance causes a voltage drop V_{LS} that counter acts the driving voltage.



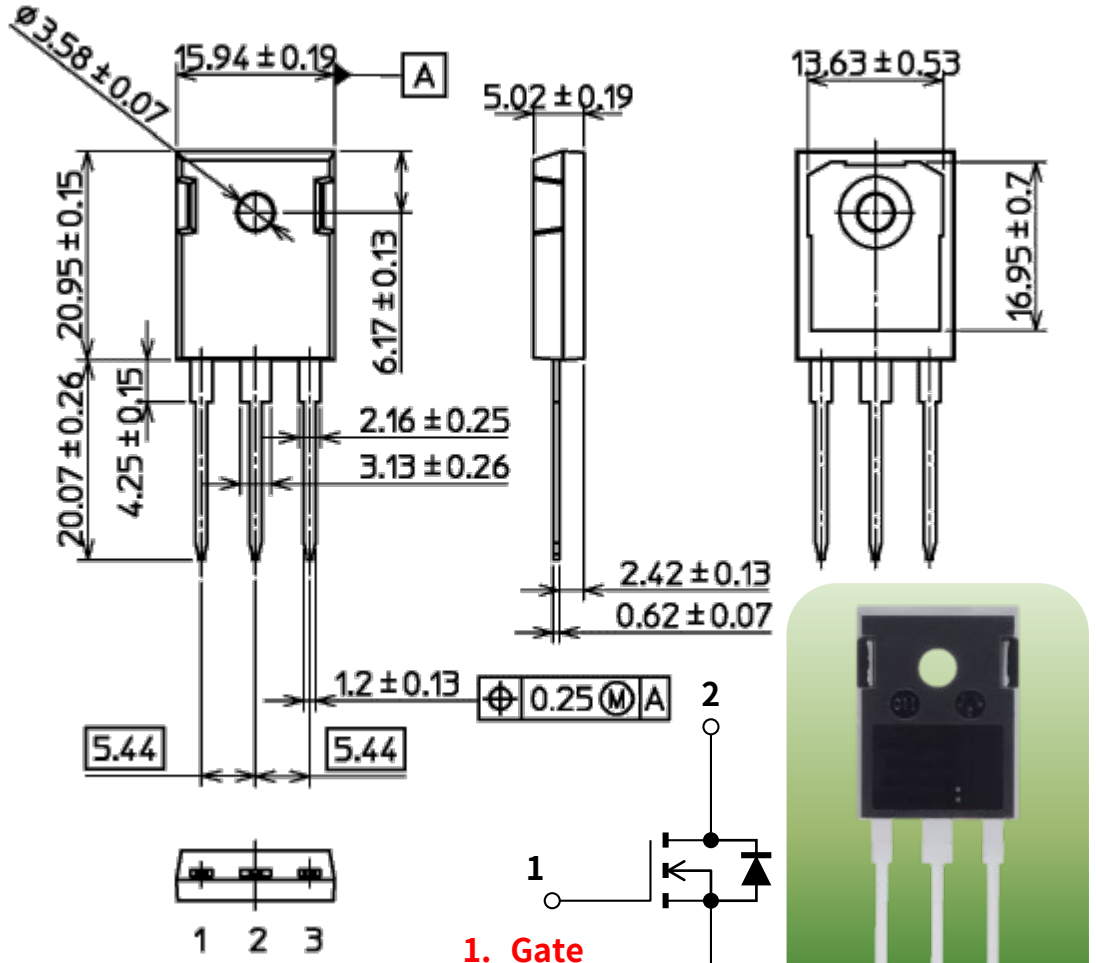
4-pin configuration

The voltage drop V_{LS} are eliminated by excluding a source inductance from driving circuit. It fully bring out the fast switching performance of MOSFET.

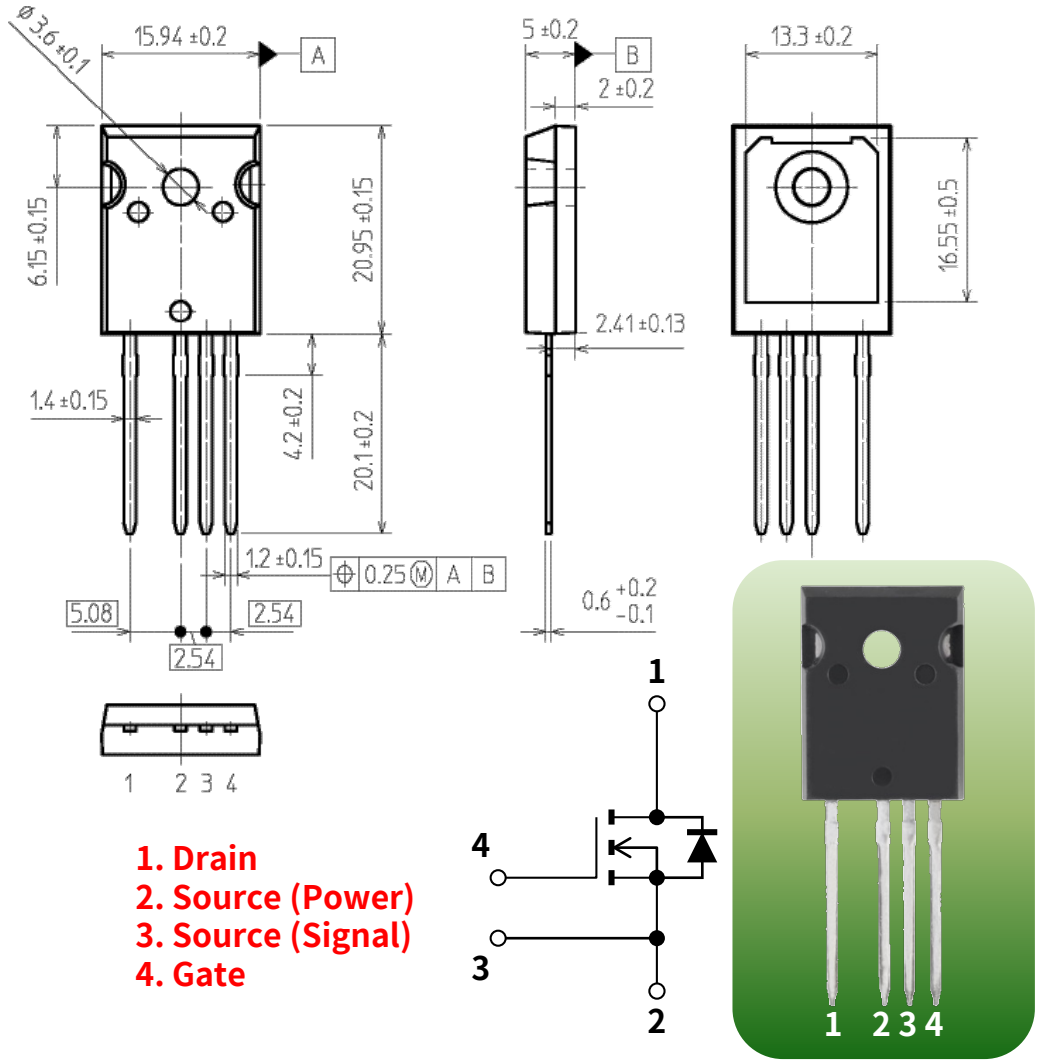


封裝尺寸和引腳分配 ～TO-247 vs TO-247-4L～

TO-247



TO-247-4L

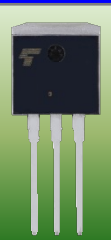


产品线介绍①

“DTMOSIV”与“DTMOSⅤ”系列

- 600V DTMOSIV系列
- 650V DTMOSIV系列
- 600V／650V DTMOSⅤ系列
- 600V／650V DTMOSIV-H（高速开关型）系列
- 600V DTMOSIV（HSD）系列
- 650V DTMOSIV（HSD）系列
- 500V／800V DTMOSIV系列

DTMOSIV（V_{DSS}＝600V）系列产品线

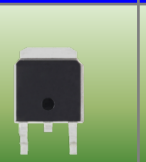
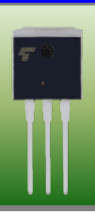
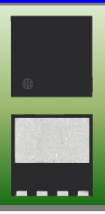
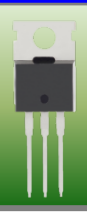
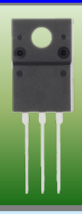
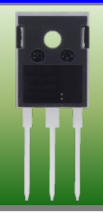
I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	IPAK (TO-251)	I2PAK (TO-262)	D2PAK (TO-263)	DFN8×8	TO-220	TO-220SIS	TO-3P(N)	TO-247	TO-3P(L)	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.
													
6.2	0.75 / 0.82	TK6P60W (0.82Ω)	TK6Q60W (0.82Ω)					TK6A60W				12	390
7	0.6	TK7P60W	TK7Q60W					TK7A60W				13	490
8	0.5	TK8P60W	TK8Q60W					TK8A60W				16	530
9.8	0.38 / 0.43	TK10P60W (0.43Ω)	TK10Q60W (0.43Ω)			TK10V60W	TK10E60W	TK10A60W				20	700
11.5	0.3 / 0.34	TK12P60W (0.34Ω)	TK12Q60W (0.34Ω)			TK12V60W	TK12E60W	TK12A60W	TK12J60W			25	890
15.8	0.19			TK16C60W	TK16G60W	TK16V60W	TK16E60W	TK16A60W	TK16J60W	TK16N60W		38	1350
20	0.155 / 0.17			TK20C60W	TK20G60W	TK20V60W (0.17Ω)	TK20E60W	TK20A60W	TK20J60W	TK20N60W		50	1700
30.8	0.088 / 0.098					TK31V60W (0.098Ω)	TK31E60W	TK31A60W	TK31J60W	TK31N60W		86	3000
38.8	0.065							TK39A60W	TK39J60W	TK39N60W		110	4100
61.8	0.040								TK62J60W	TK62N60W		180	6500
100	0.018										TK100L60W	360	15000

Lower $R_{DS(ON)}$ available by DTMOSIV series

Under Investigation → Making ES → ES available → Under MP → NRND(*)

* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

DTMOSIV（V_{DSS}＝650V）系列产品线

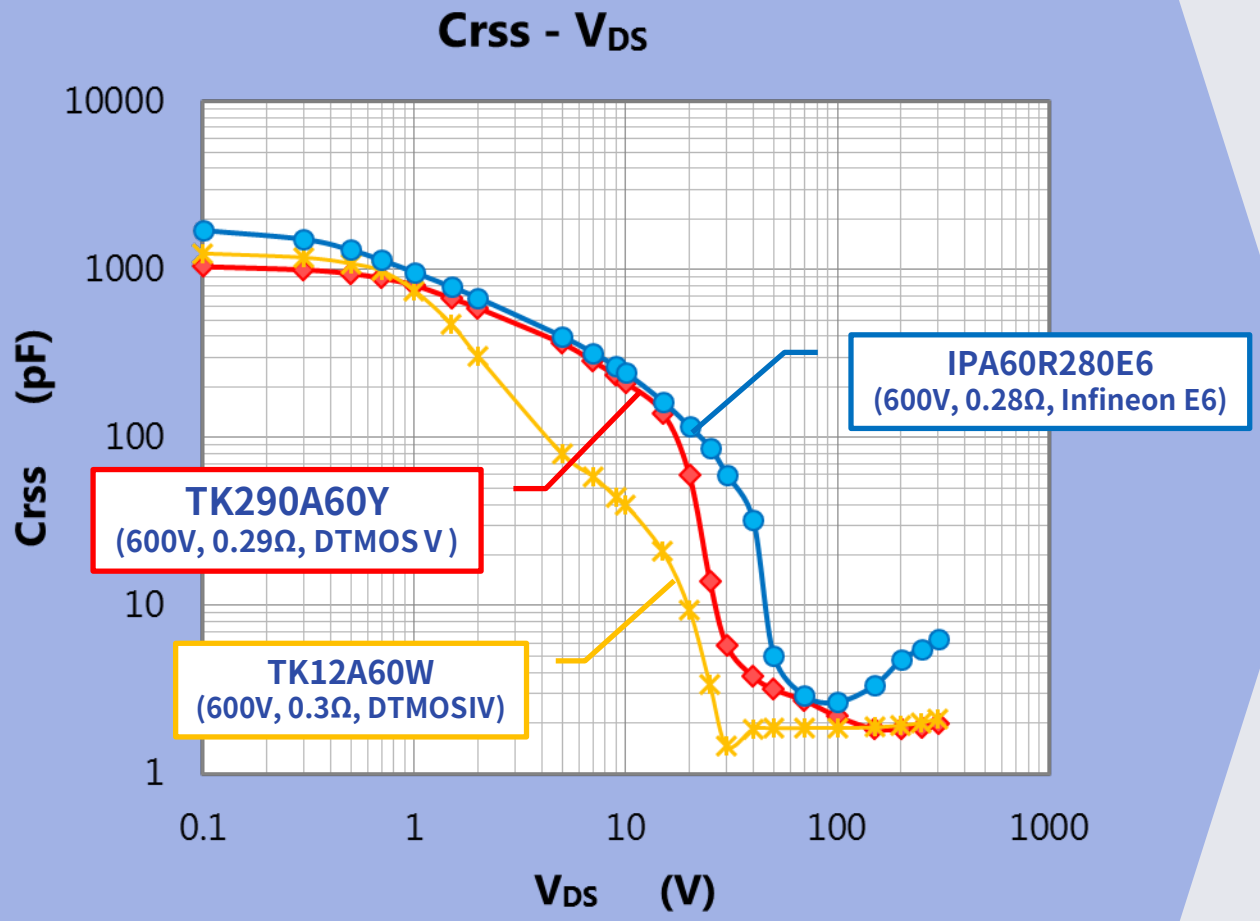
I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	IPAK (TO-251)	I2PAK (TO-262)	D2PAK (TO-263)	DFN8×8	TO-220	TO-220SIS	TO-247	Q_g Typ. (nC)	C_{iss} (V_{DS}=300V) Typ. (pF)
											
5.8	1.0 / 1.05	TK6P65W (1.05Ω)	TK6Q65W (1.05Ω)					TK6A65W		11	390
6.8	0.78 / 0.80	TK7P65W (0.80Ω)	TK7Q65W (0.80Ω)					TK7A65W		15	490
7.8	0.65 / 0.67	TK8P65W (0.67Ω)	TK8Q65W (0.67Ω)					TK8A65W		16	570
9.3	0.5 / 0.56	TK9P65W (0.56Ω)	TK9Q65W (0.56Ω)					TK9A65W		20	700
11.1	0.39 / 0.44	TK11P65W (0.44Ω)	TK11Q65W (0.44Ω)					TK11A65W		25	890
13.7	0.25 / 0.28			TK14C65W	TK14G65W	TK14V65W (0.28Ω)	TK14E65W	TK14A65W	TK14N65W	35	1300
17.3	0.2 / 0.21			TK17C65W		TK17V65W (0.21Ω)	TK17E65W	TK17A65W	TK17N65W	45	1800
22	0.15							TK22A65X		50	2400
27.6	0.11 / 0.12					TK28V65W (0.12Ω)	TK28E65W	TK28A65W	TK28N65W	75	3000
35	0.08							TK35A65W	TK35N65W	100	4100
49.2	0.055								TK49N65W	160	6500

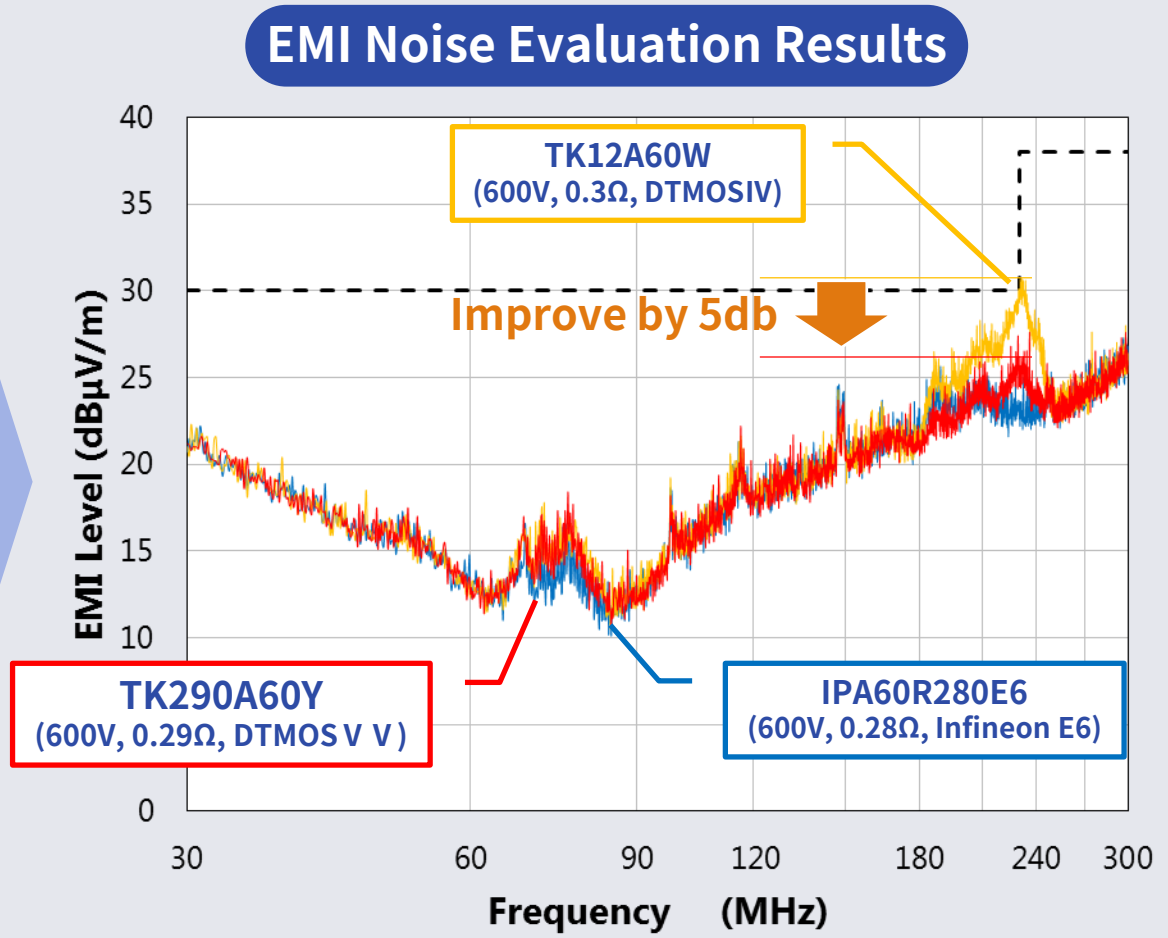
Under Investigation → Making ES → ES available → Under MP → NRND(*)

* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

DTMOS V 系列 ～低EMI噪声型～

By gate design optimization, DTMOS V achieve lower EMI noise level.

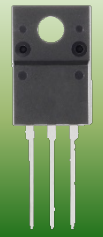




※ Internal evaluation result on a PFC inside a TV set (Horizontal polarized wave)

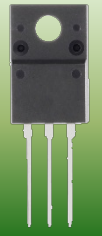
DTMOS V 系列产品线

V_{DSS}=600V

I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	TO-220SIS	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.
					
7	0.56	TK560P60Y	TK560A60Y	14.5	380
9.7	0.38	TK380P60Y	TK380A60Y	20	590
11.5	0.29	TK290P60Y	TK290A60Y	25	730

Under Investigation → Making ES → ES available → Under MP → NRND(*)

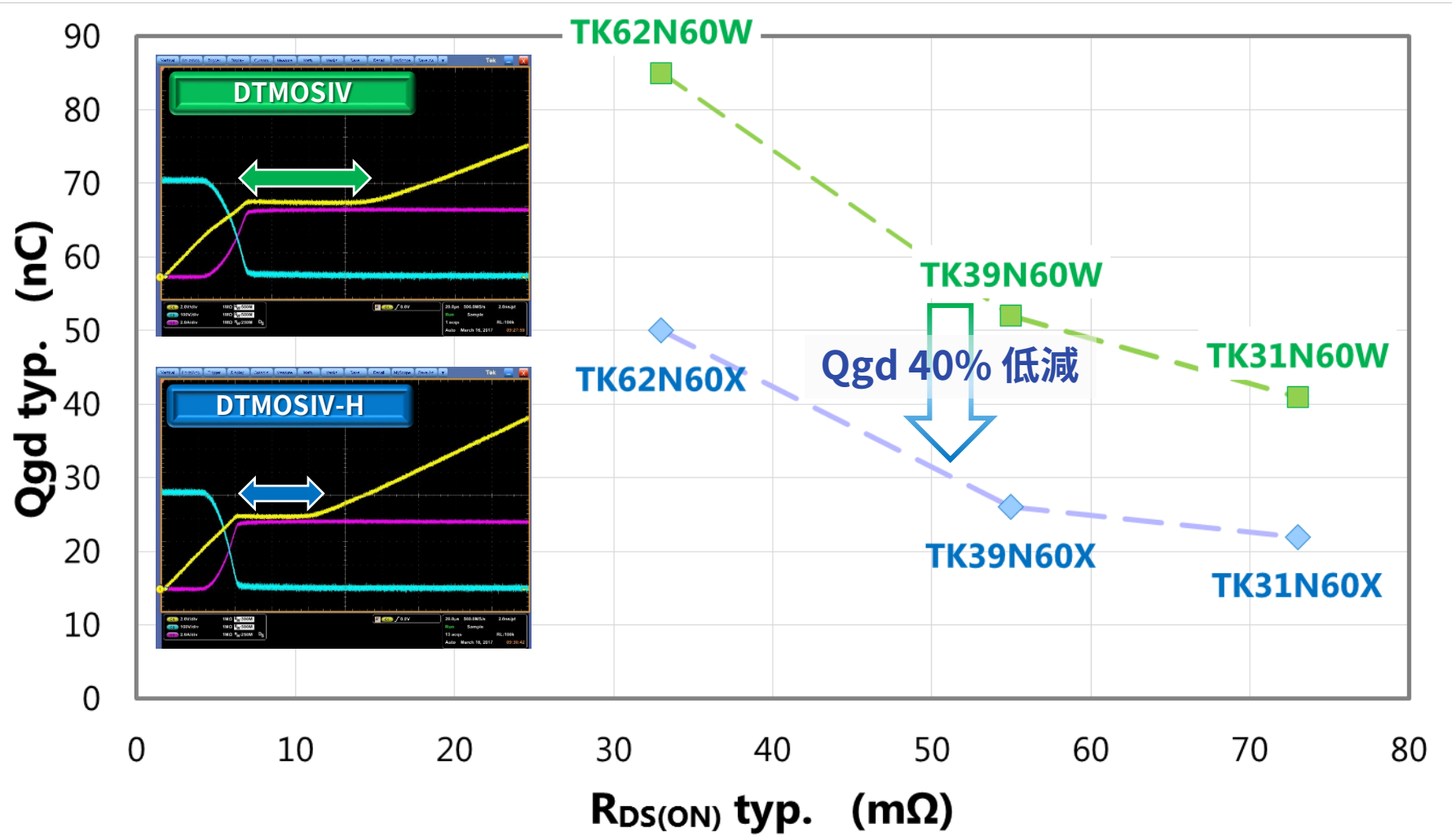
V_{DSS}=650V

I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	TO-220SIS	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.
					
7	0.56	TK560P65Y	TK560A65Y	14.5	380
9.7	0.38	TK380P65Y	TK380A65Y	20	590
11.5	0.29	TK290P65Y	TK290A65Y	25	730

* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

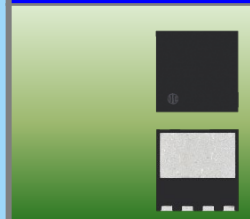
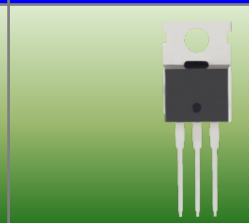
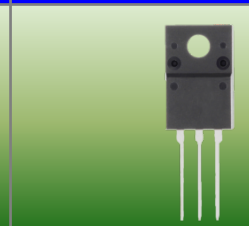
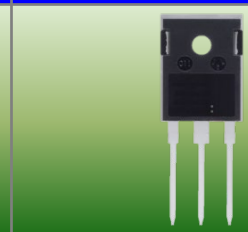
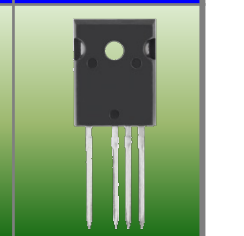
高速开关型“DTMOSIV-H”系列

40% lower Qgd by gate design change from DTMOSIV series leads to “High efficiency”.



DTMOSIV-H（高速开关型）系列产品线

New Package

V_{DSS} (A)	I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DFN8x8		TO-220		TO-220SIS		TO-247		TO-247-4L	Q_g (nC) Typ.	
													
			W	X	W	X	W	X	W	X	X	W	X
600	15.8	0.19	TK16V60W		TK16E60W		TK16A60W		TK16N60W			38	-
	20	0.155 / 0.17	TK20V60W (0.17Ω)		TK20E60W		TK20A60W		TK20N60W			48	-
	25	0.125 / 0.135		**TK25V60X (0.135Ω)**		**TK25E60X**		**TK25A60X**		**TK25N60X**	**TK25Z60X**	-	40
	30.8	0.088 / 0.098	TK31V60W (0.098Ω)	**TK31V60X (0.098Ω)**	TK31E60W	**TK31E60X**	TK31A60W		TK31N60W	**TK31N60X**	**TK31Z60X**	86	65
	38.8	0.065					TK39A60W		TK39N60W	**TK39N60X**	**TK39Z60X**	110	85
	61.8	0.040							TK62N60W	**TK62N60X**	**TK62Z60X**	180	135
650	22	0.15						**TK22A65X**				-	50

Under Investigation → Making ES → ES available → Under MP → NRND(*)

* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

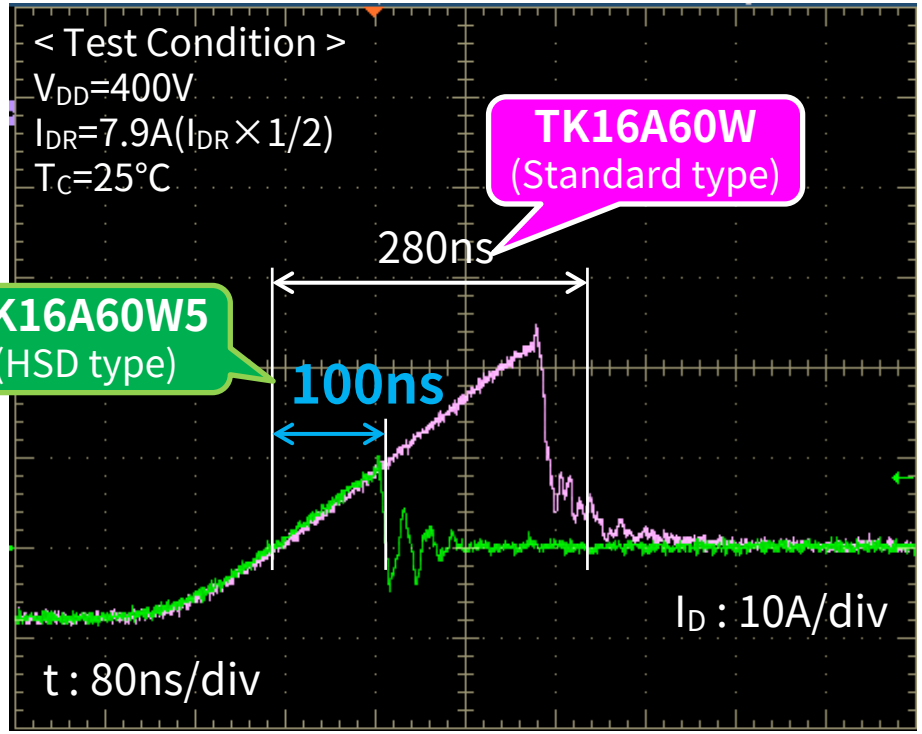
TK62N60□
- "W" ··· Standard type
- "X" ··· High-Speed Switching type

快速恢复体二极管型“DTMOSIV（HSD）”系列

Fast Recovery body diode type based on DTMOSIV series, which make more efficient.

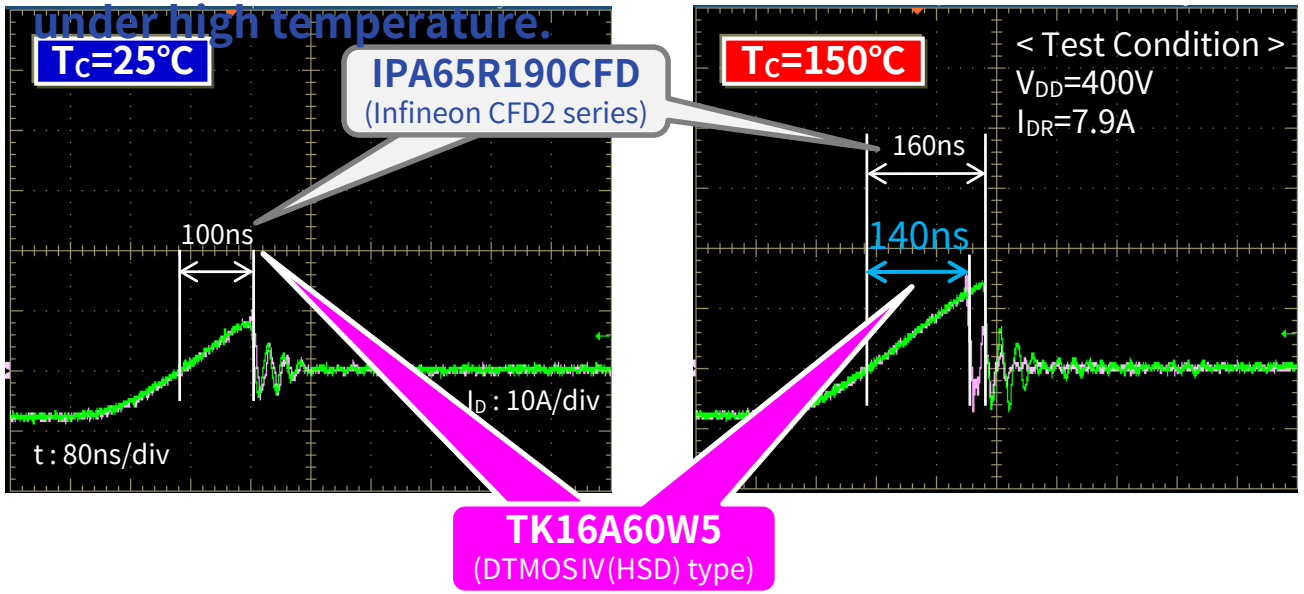
“Standard” type vs “HSD” type

HSD type can reduce “Recovery Loss” due to 70% shorter trr.

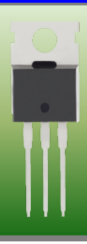
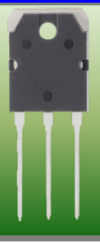


Better temperature coefficient

Due to better temperature coefficient of trr, DTMOSIV(HSD) type can achieve lower switching loss under high temperature.



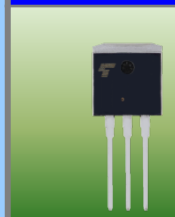
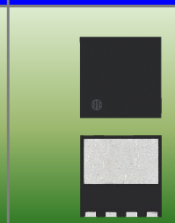
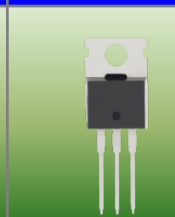
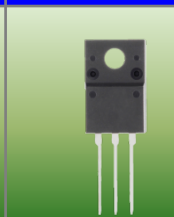
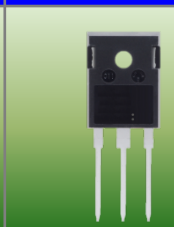
DTMOSIVHSD（V_{DSS}＝600V，带高速恢复二极管）系列产品线

I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	D2PAK (TO-263)	DFN8×8	TO-220	TO-220SIS	TO-3P(N)	TO-247	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.	t_{rr} (ns) Typ.
											
7	0.65 / 0.67	TK7P60W5 (0.67Ω)				TK7A60W5			16	490	75
8	0.54 / 0.56	TK8P60W5 (0.56Ω)				TK8A60W5			22	590	80
9.7	0.45					TK10A60W5			23	720	85
15.8	0.23 / 0.24		TK16G60W5	TK16V60W5 (0.24Ω)	TK16E60W5	TK16A60W5	TK16J60W5	TK16N60W5	43	1350	100
20	0.175 / 0.19			TK20V60W5 (0.19Ω)	TK20E60W5	TK20A60W5	TK20J60W5	TK20N60W5	55	1800	110
25	0.14 / 0.15	High-speed Switching “X” w/HSD		TK25V60X5 (0.15Ω)	TK25E60X5	TK25A60X5		TK25N60X5	60	2400	120
30.8	0.099 / 0.109			TK31V60W5 (0.109Ω)			TK31J60W5	TK31N60W5	105	3000	135
38.8	0.074						TK39J60W5	TK39N60W5	135	4100	150
61.8	0.045						TK62J60W5	TK62N60W5	205	7100	170

Under Investigation → Making ES → ES available → Under MP → NRND(*)

* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

DTMOSIVHSD（V_{DSS}＝650V，带高速恢复二极管）系列产品线

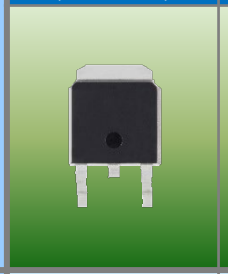
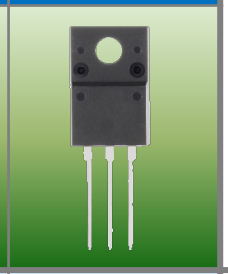
I_D (A)	$R_{DS(ON)}$ MAX (Ω)	I2PAK (TO-262)	D2PAK (TO-263)	DFN8x8	TO-220	TO-220SIS	TO-247	Q_g Typ. (nC)	C_{iss} (V_{DS}=300V) Typ. (pF)	t_{rr} Typ. (ns)
										
13.7	0.30	TK14C65W5	TK14G65W5		TK14E65W5	TK14A65W5	TK14N65W5	40	1300	100
17.3	0.23					TK17A65W5		50	1800	110
22	0.16 / 0.17			TK22V65X5 (0.17Ω)		TK22A65X5		50	2400	110
27.6	0.13 / 0.14			TK28V65W5 (0.14Ω)			TK28N65W5	90	3000	115
35	0.095					TK35A65W5	TK35N65W5	115	4100	130
49.2	0.057						TK49N65W5	185	6500	145

Under Investigation → Making ES → ES available → Under MP → NRND(*)

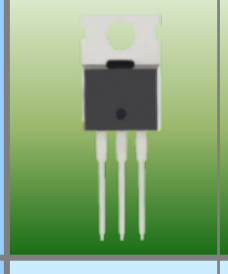
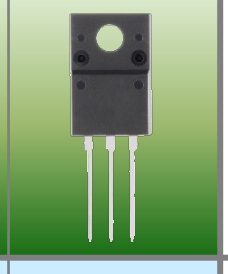
* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

DTMOSIV（V_{DSS}＝500V＆800V）系列产品线

V_{DSS}=500V

I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	TO-220SIS	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.
					
9.7	0.38 / 0.43	TK10P50W (0.43Ω)	TK10A50W	20	700
11.5	0.3 / 0.34	TK12P50W (0.34Ω)	TK12A50W	25	890
18.5	0.19		TK19A50W	38	1350

V_{DSS}=800V

I_D (A)	$R_{DS(ON)}$ MAX (Ω)	TO-220	TO-220SIS	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.	r_g (Ω) Typ.
						
6.5	0.95	TK7E80W	TK7A80W	13	700	30
9.5	0.55	TK10E80W	TK10A80W	19	1150	35
11.5	0.45	TK12E80W	TK12A80W	23	1400	30
17	0.29	TK17E80W	TK17A80W	32	2050	6

Under Investigation → Making ES → ES available → Under MP → NRND(*)

* : Not Recommended for New design.
Note: Specifications of products under development may change without prior notice.

产品线介绍②

“π-MOS”系列

- 450V~650V π-MOSⅦ系列
- 200V~300V π-MOSⅦ系列
- 800V~900V π-MOSⅧ系列

“π-MOSⅦ”（V_{DSS}＝450V／500V）系列产品线

V_{DSS} (V)	I_D (A)	$R_{DS(ON)}$ max.(Ω) @V_{GS}=10V	DPAK	TO-220SIS	TO-3P(N)	Qg typ. (nC)	Ciss typ. (pF)
450	4.5	1.75		TK5A45DA		9	380
	5.5	1.35		TK6A45DA		11	490
	6.5	1.2		TK7A45DA		11	540
	8	0.9		TK8A45D		16	700
	9	0.77		TK9A45D		16	800
	11	0.62		TK11A45D		20	1050
	12	0.52		TK12A45D		24	1200
	13	0.46		TK13A45D		25	1350
	15	0.25		TK19A45D		45	2600
500	3	3.0	TK3P50D			7	280
	4	2.0	TK4P50D	TK4A50D		9	380
	5	1.5	TK5P50D	TK5A50D		11	490
	6	1.4		TK6A50D		11	540
	7	1.22	TK7P50D	TK7A50D		12	600
	7.5	1.04		TK8A50DA		16	700
	8	0.85		TK8A50D		16	800
	10	0.72		TK10A50D		20	1050
	11	0.6		TK11A50D		24	1200
	12	0.52		TK12A50D		25	1350
	12.5	0.47		TK13A50DA		28	1550
	13	0.4		TK13A50D		38	1800
	15	0.4			TK15J50D	38	1800
	15	0.3		TK15A50D		40	2300
	18	0.27		TK18A50D		45	2600
	20	0.27			TK20J50D	45	2600

Under Investigation → Making ES → ES available → Under MP → NRND(*)

• : Not Recommended for New Design.

Note: Specifications of products under development may change without prior notice.

“π-MOSⅦ”（V_{DSS}＝525V／550V）系列产品线

V_{DSS} (V)	I_D (A)	$R_{DS(ON)}$ max.(Ω) @V_{GS}=10V	DPAK	TO-220SIS	TO-3P(N)	Qg typ. (nC)	Ciss typ. (pF)
525	4	1.7		TK4A53D		11	490
	5	1.5	TK5P53D	TK5A53D		11	540
	6	1.3	TK6P53D	TK6A53D		12	600
	12	0.58		TK12A53D		25	1350
550	3.5	2.45	TK4P55DA	TK4A55DA		9	380
	4	1.88	TK4P55D	TK4A55D		11	490
	5	1.7		TK5A55D		11	540
	5.5	1.48		TK6A55DA		12	600
	7	1.25		TK7A55D		16	700
	7.5	1.07		TK8A55DA		16	800
	8.5	0.86		TK9A55DA		20	1050
	10	0.72		TK10A55D		24	1200
	11	0.63		TK11A55D		25	1350
	12	0.57		TK12A55D	TK12J55D	28	1550
	12.5	0.48		TK13A55DA		38	1800
	14	0.37		TK14A55D		40	2300
	16	0.37			TK16J55D	40	2300
	16	0.33		TK16A55D		45	2600
	19	0.33			TK19J55D	45	2600

Under Investigation → Making ES → ES available → Under MP → NRND(*)

• : Not Recommended for New Design.
Note: Specifications of products under development may change without prior notice.

“π-MOSⅦ” （V_{DSS}＝600V／650V）系列产品线

V_{DSS} (V)	I_D (A)	$R_{DS(ON)}$ max.(Ω) @V_{GS}=10V	New PW-MOLD2	New PW-MOLD	DPAK	TO-220SIS	Qg typ. (nC)	Ciss typ. (pF)
600	2	4.3	TK2Q60D	TK2P60D			7	280
	2.5	2.8				TK3A60DA	9	380
	3.5	2.2	TK4Q60DA		TK4P60DA	TK4A60DA	11	490
	3.7	2.0			TK4P60DB	TK4A60DB	11	540
	4	1.7			TK4P60D	TK4A60D	12	600
	5	1.43				TK5A60D	16	700
	6	1.25				TK6A60D	16	800
	7.5	1.0				TK8A60DA	20	1050
	9	0.83				TK9A60D	24	1200
	10	0.75				TK10A60D	25	1350
	11	0.65				TK11A60D	28	1550
	12	0.55				TK12A60D	38	1800
	13	0.43				TK13A60D	40	2300
	15	0.37				TK15A60D	45	2600
650	2	3.26				TK2A65D	9	380
	2.5	2.51				TK3A65DA	11	490
	3	2.25				TK3A65D	11	540
	3.5	1.9				TK4A65DA	12	600
	4.5	1.67				TK5A65DA	16	700
	5	1.43				TK5A65D	16	800
	6	1.11				TK6A65D	20	1050
	7	0.98				TK7A65D	24	1200
	8	0.84				TK8A65D	25	1350
	11	0.7				TK11A65D	30	1700
	12	0.54				TK12A65D	40	2300
	13	0.47				TK13A65D	45	2600

For new design, π-MOSIX series are highly recommended.

TK4A60DB ➔ TK2K2A60F
TK4A60DB ➔ TK1K9A60F
TK4A60DB ➔ TK1K7A60F
TK6A60D ➔ TK1K2A60F
TK4A60DB ➔ TK1K0A60F
TK10A60D ➔ TK750A60F
TK11A60D ➔ TK650A60F

TK13A60D ➔ TK430A60F (MP preparation)
TK15A60D ➔ TK370A60F (MP preparation)

Under Investigation → Making ES → ES available → Under MP → NRND(*)

• : Not Recommended for New Design.
Note: Specifications of products under development may change without prior notice.

“π-MOSⅦ”（V_{DSS}＝200~300V）系列产品线

V_{DSS} (V)	I_D (A)	$R_{DS(ON)}$ MAX (Ω)	DPAK (TO-252)	TO-220	TO-220SIS	TO-3P(N)	Q_g (nC) Typ.	C_{iss} (V_{DS}=300V) (pF) Typ.
								
200	8.5	0.4			TK9A20DA		14	550
	15	0.18			TK15A20D		26	1050
	20	0.109			TK20A20D		43	1650
	25	0.07			TK25A20D		60	2550
	40	0.044				TK40J20D	100	4300
	70	0.027				TK70J20D	160	6950
250	7.5	0.5	TK8P25DA		TK8A25DA		16	550
	13	0.25	TK13P25D	TK13E25D	TK13A25D		25	1100
	17	0.15			TK17A25D		43	1650
	20	0.1			TK20A25D		55	2550
	30	0.060				TK30J25D	100	4300
	60	0.038				TK60J25D	160	6950
300	18	0.139			TK18A30D		60	2600
	50	0.052				TK50J30D	160	7000

Under Investigation → Making ES → ES available → Under MP → NRND(*)

• : Not Recommended for New Design.

Note: Specifications of products under development may change without prior notice.

“高压π-MOSⅧ” （V_{DSS}＝800~900V）系列产品线

V_{DSS} (V)	I_D (A)	$R_{DS(ON)}$ MAX (Ω)	Package	Part No.	Status	Conventional Part No. (π-MOSIV series)
800	3	4.9	DPAK	TK3P80E	In production	
	4	3.5	TO-220SIS	TK4A80E	In production	
	5	2.4	TO-220SIS	TK5A80E	In production	
	6	1.7	TO-220SIS	TK6A80E	In production	2SK4013
	10	1.0	TO-220SIS	TK10A80E	In production	
	10	1.0	TO-3P(N)	TK10J80E	In production	
900	2	5.9	DPAK	TK2P90E	In production	
	2.5	4.6	TO-220SIS	TK3A90E	In production	
	4.5	3.1	TO-220SIS	TK5A90E	In production	
	7	2	TO-220SIS	TK7A90E	In production	2SK3565 (2.5Ω) 2SK3742 (2.5Ω) 2SK4014 (2.0Ω)
	7	2	TO-3P(N)	TK7J90E	In production	2SK4115
	9	1.3	TO-220SIS	TK9A90E	In production	2SK3799
	9	1.3	TO-3P(N)	TK9J90E	In production	2SK3878

Note: Specifications of products under development may change without prior notice.

03

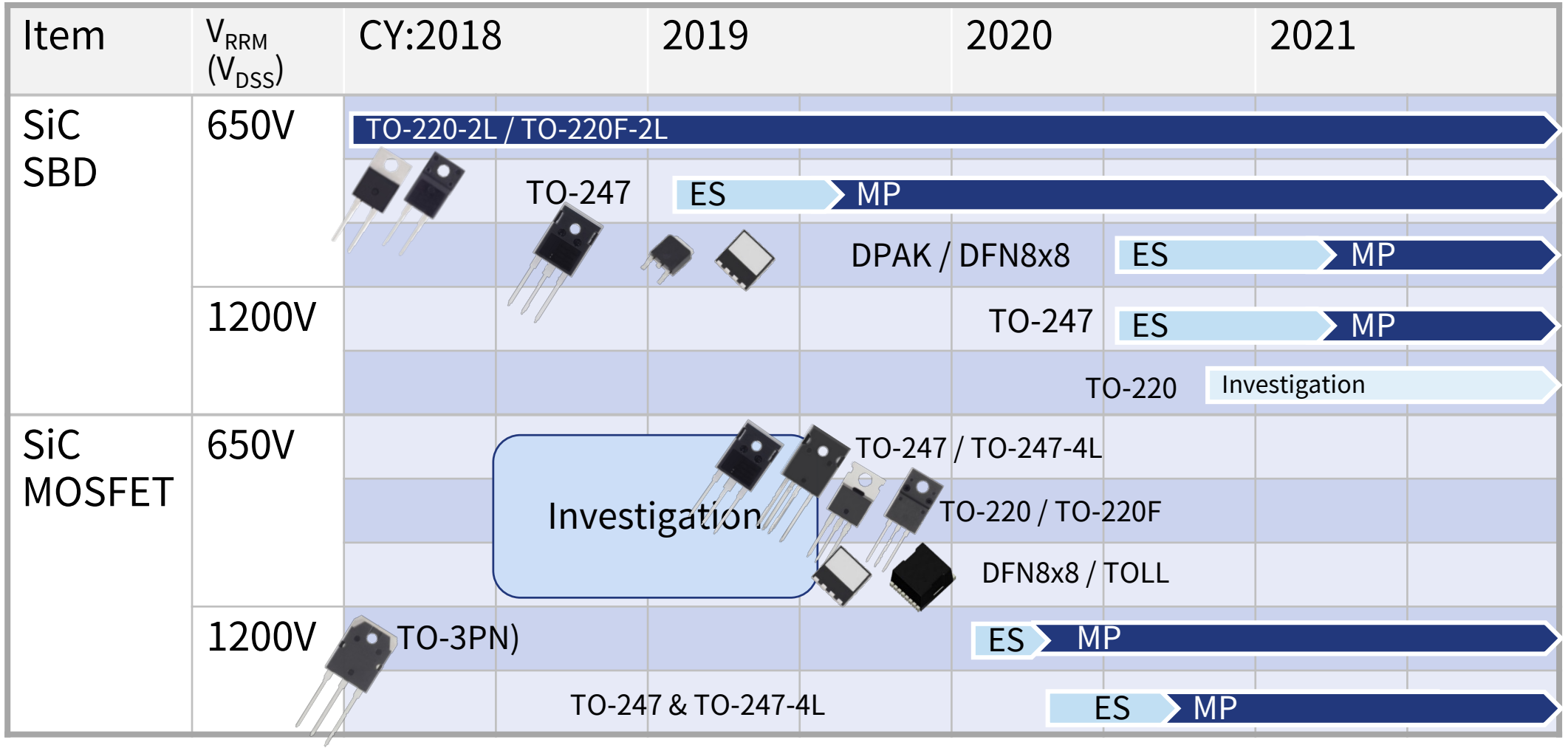
SiC器件

SiC器件

- 第2代SiC SBD（650V）
- 新产品：SiC MOSFET（1200V）

SiC SBD／MOSFET产品路线图

We plan to increase the line-up by various package and electric current rating.



第2代SiC SBD（650V）

Modified JBS structure achieves low leakage current, low loss and high surge current capability.

1 Low I_R

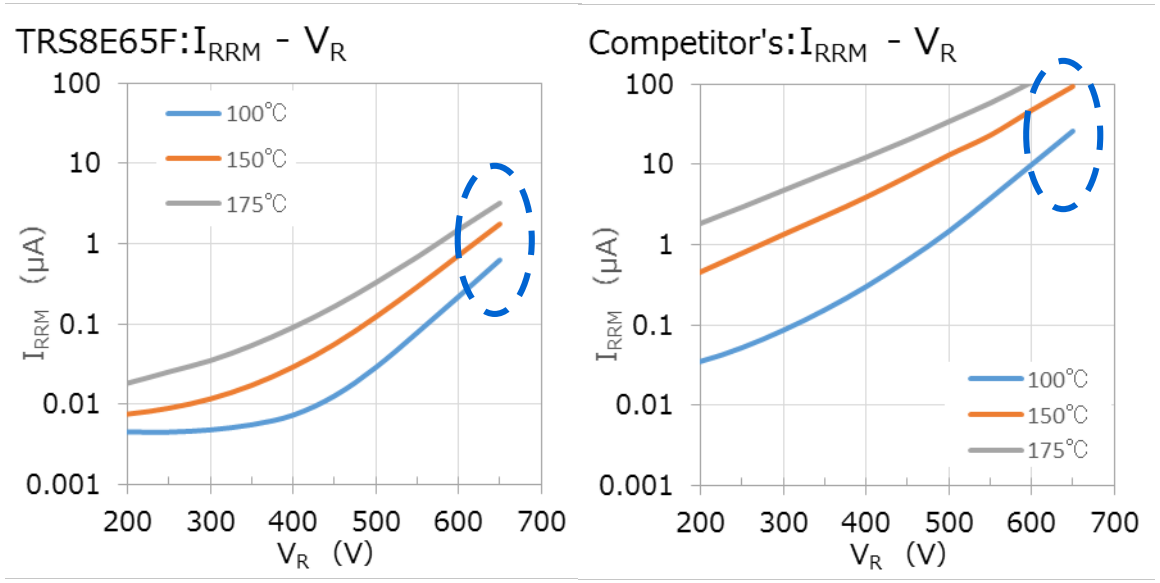
- Due to modified JBS structure makes lower I_R.
- I_R: 50μA max @650V, 25°C

2 Low V_F

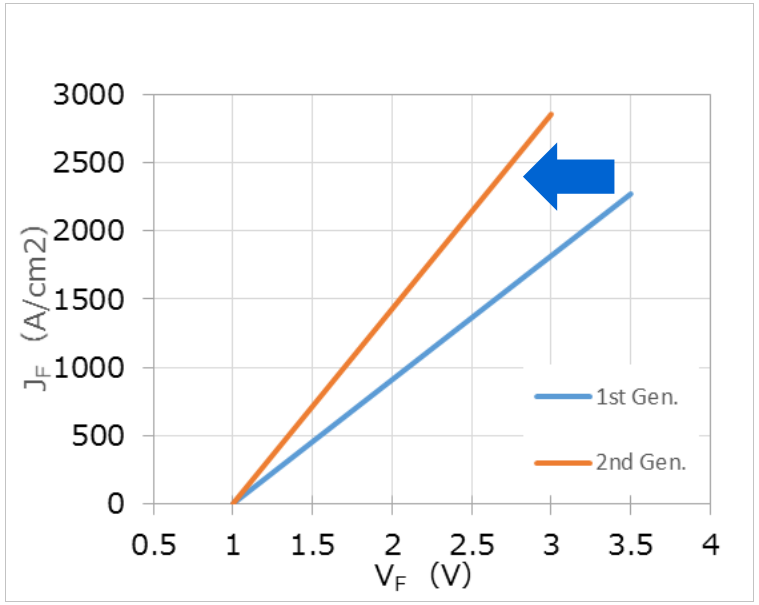
- Due to thinner wafer technology, we achieve lower V_F compared with 1st generation.
- V_F spec: 1.45V (typ.)

I_R comparison in high temp.

2digit lower than the competitors.



J_F v.s. V_F curve comparison



第2代SiC SBD（650V）

Modified JBS structure achieves low leakage current, low loss and high surge current capability.

3 Low Switching loss P_{QC}

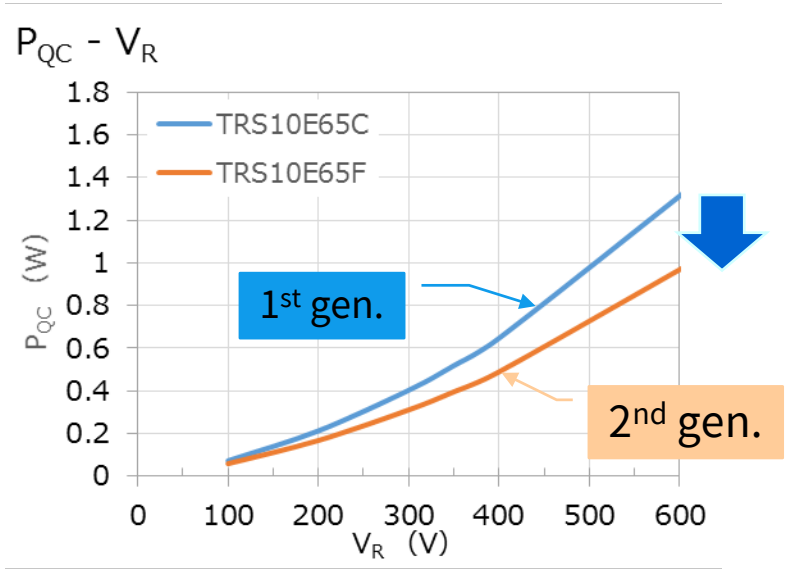
- Due to the thinner wafer technology, 30% lower than 1st generation SiC SBD.

4 High I_{FSM}

- Due to modified JBS technology, we achieve higher surge current capability I_{FSM} compared with 1st generation. (83A@TRS10E65F)

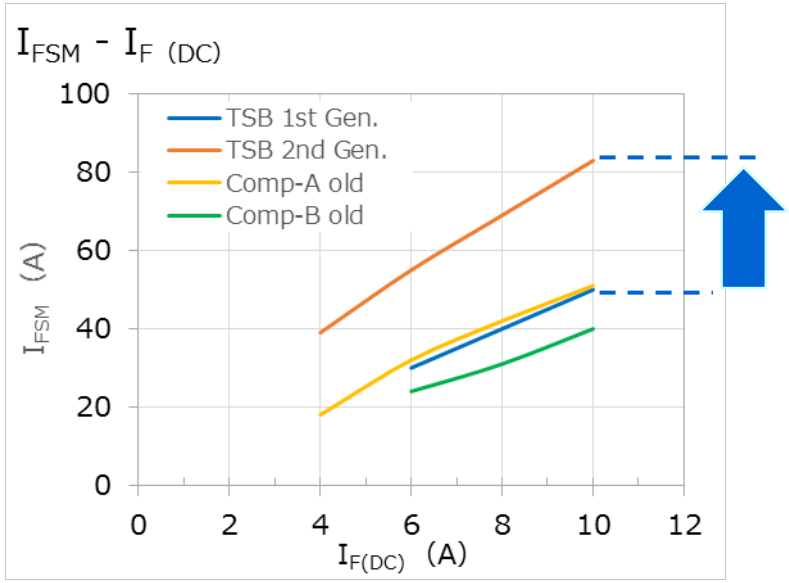
Switching loss comparison@100kHz

Reduce 30% switching Loss of 1st generation.



I_{FSM} capability comparison.

Improve to twice value of 1st generation.



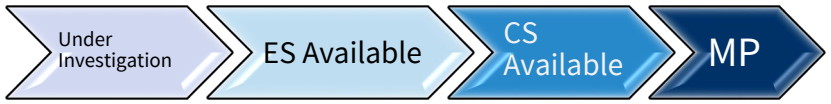
第2代SiC SBD产品线

V_{RRM} (V)	$I_{F(DC)}$ (A)	TO-220F-2L	TO-220-2L	TO-247 (Center tap)
				
650	2		TRS2E65F	
	3		TRS3E65F	
	4	TRS4A65F	TRS4E65F	
	6	TRS6A65F	TRS6E65F	
	8	TRS8A65F	TRS8E65F	
	10	TRS10A65F	TRS10E65F	
	12	TRS12A65F (1)	TRS12E65F (2)	TRS12N65FB (3)
	16			TRS16N65FB (3)
	20			TRS20N65FB (3)
	24			TRS24N65FB (3)

We are developing higher current SBD products (over 12A).

Development schedule.

	ES	CS	MP
(1)	OK	OK	OK
(2)	OK	Apr. 2019	May. 2019
(3)	OK	Aug. 2019	Nov. 2019

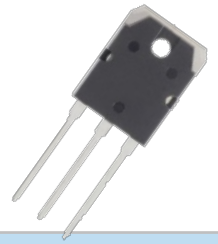
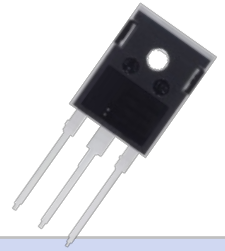
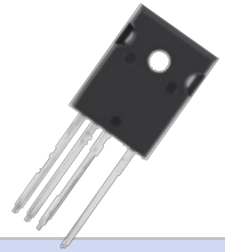


SiC器件

- 第2代SiC SBD（650V）
- 新产品：SiC MOSFET（1200V）

SiC MOSFET产品线计划

■ Schedule

V_{DSS} (V)	$R_{DS(ON)}$ (mΩ)		TO-3P(N)	TO-247	TO-247-4L
	(Typ.)	(Max)			
1200	70	90	TW070J120B ES：Jan. 2020 MP：Jun. 2020	TW070N120B Under investigation	TW070Z120B Under investigation

■ Feature (Compare with competitor)

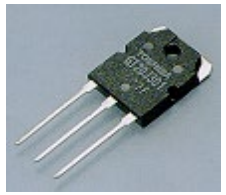
	Rohm		Cree		TOSHIBA
	SCT2	SCT3	C2M	C3M	
$R_{DS(ON)}$ (Typ.)	80mΩ	80mΩ	80mΩ	75mΩ	70mΩ
$+V_{GSS}/-V_{GSS}$	+22V/−6V	+22V/−4V	+25V/−10V	+19V/−8V	+25V/−10V
V_{th}	1.6~4.0V	2.7~5.6V	2.0~4.0V	1.7~4.0V	4.2~5.8V
V_{DSF} (Typ.)	4.6V	3.2V	3.3V	4.5V	1.35V

04

分立IGBT

电机驱动应用

第6代硬开关产品线

I_C	Part Number	$V_{CE(sat)}$ @Ic		P_C	Package	
		Typ.	Max			
15A	**GT15J341**	1.5V	2.0V	30W	TO-220SIS	
20A	**GT20J341**			45W	TO-220SIS	
30A	**GT30J341**			230W	TO-3P(N)	

空调PFC应用

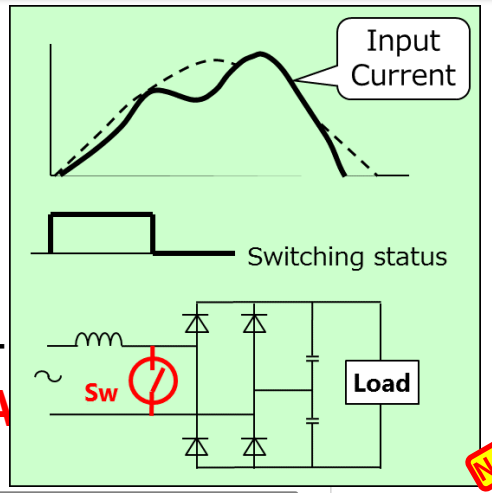
适用PFC（空调）：拓扑和状态

Low $V_{CE(sat)}$ type IGBT is suitable for partial switching,
Faster switching type IGBT for active PFC topology.
Toshiba prepare IGBTs for both solution

Comparison between Partial & Active PFC, and Recommended P/N

Partial Switching
(～ 120 Hz)

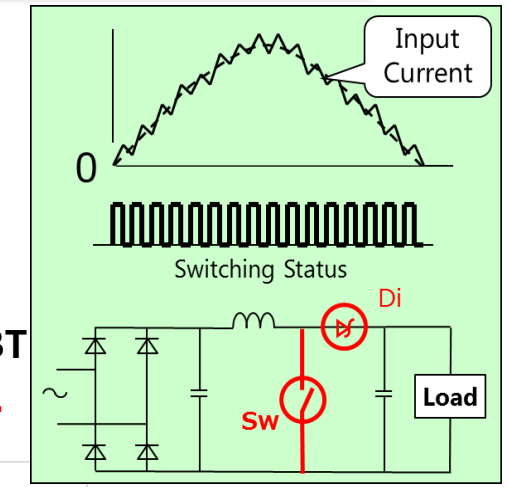
- ❒ PF=98~99%
  Achieved hi-PF with very simple circuit topology
- ❒ Required Low $V_{CE(sat)}$ type
- ❒ Recommended IGBT
  P/N：GT30J122A



Active PFC
(20~35kHz)

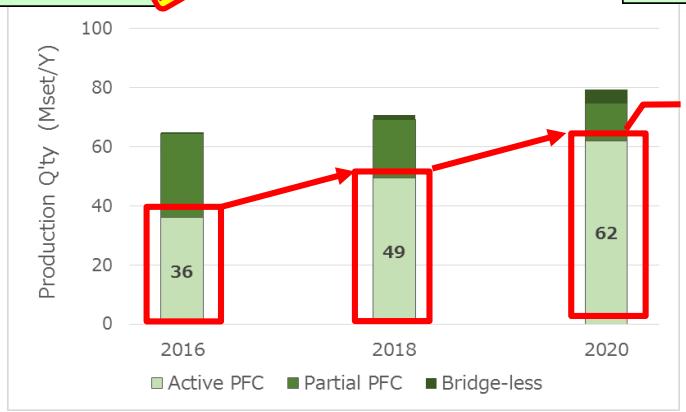
- ❒ PF≒100%
  Available to use very compact reactor
- ❒ Required faster switching type
- ❒ Recommended IGBT
  P/N : GT50JR22
  P/N : GT50J123

New!



Active PFC vs Partial Switching

- ❒ Production : Increasing Active PFC
  because China major customers are using
- ❒ Topology : Single PFC with faster switching type IGBT is major



Active PFC type increasing

(Data source :
Toshiba modified based on JRAIA marketing data)

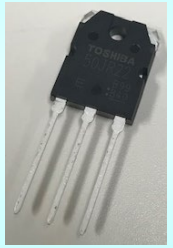
适用PFC（空调）：用于有源PFC的GT50JR22

GT50JR22 is optimally designed for active PFC of Air-conditioner, since it has the both of low $V_{CE(sat)}$ at higher current region & very faster switching performance.

Part number	Maximum Ratings			Electrical Characteristics			FWD
	V_{CES} (V)	$I_{C(DC)}$ (A)	I_{CP} (A)	$V_{CE(sat)}$ (V)	$V_{CE(sat)}$ @I_C	t_f @Resisitive load (μs)	
GT50JR22	600	50 44(@100°C)	100 (1ms)	1.55 typ.	50A	0.05 typ.	with (RC- structure)

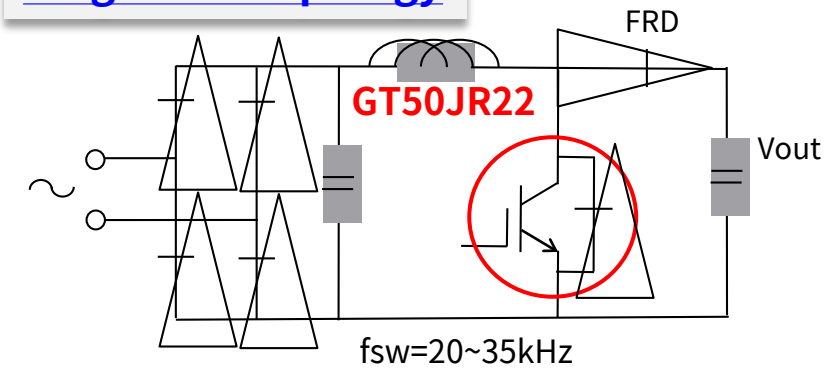
(Note：Please study ” GT50JR22(S1WLD,E,S when the switching frequency is 20kHz or higher.)

GT50JR22



TO-3P(N)
(Similar TO-247)

Single PFC topology

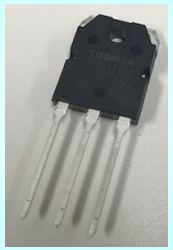


适用PFC（空调）：用于有源PFC的新产品GT50J123

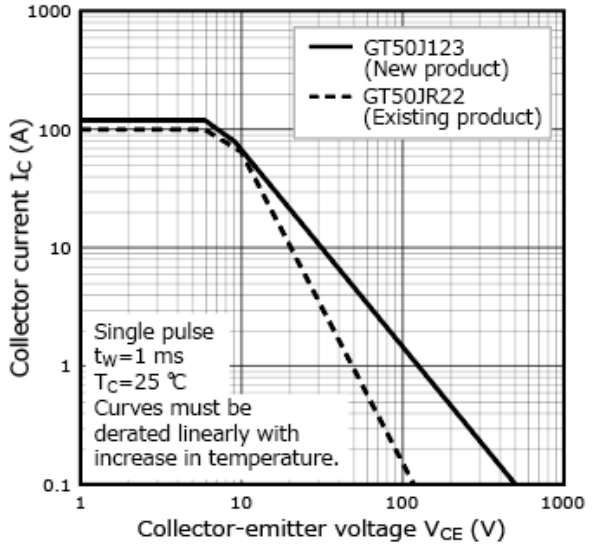
GT50J123 has expanded its Safe Operating Area compared with the existing product GT50JR22 so that it is less likely to break down during abnormal operation such as lightning surges and power supply voltage fluctuation.

Part number	Maximum Ratings			Electrical Characteristics			FWD
	V_{CES} (V)	$I_{C(DC)}$ (A)	I_{CP} (A)	$V_{CE(sat)}$ (V)	@I_C	t_f @Inductive load (μs)	
New! GT50J123	600	59 33(@100°C)	120 (1ms)	1.9 typ.	50A	0.04 typ.	Non

GT50J123



TO-3P(N)
(Similar TO-247)



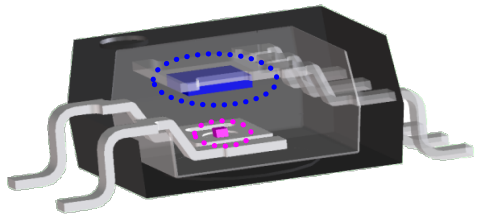
Safe Operating Area

05

光耦

05-a

介绍



光耦产品线

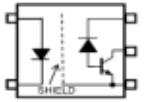
Industrial

Functional sort

- Data isolation
- Feedback (Sensing)
- Pre-driver
- Switch

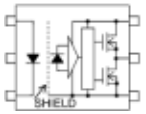
IC output type

Data isolation



High Speed I/O
- 20k～50Mbps

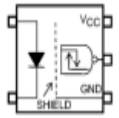
Pre-driver



IGBT drive
- 0.6-6.0A output

IPM Interface
- 1-10Mbps

Feedback

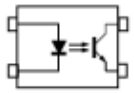


Isolation Amp
- Analog output
- Digital output

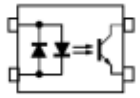
TR output type

Data isolation

Switch Feedback

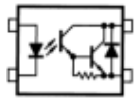


DC input
TLP385
TLP383(low IF)



AC input
TLP290
TLP292(low IF)

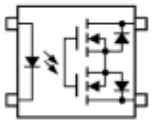
Switch Pre-driver



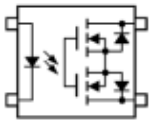
Darlington Tr
TLP187

Photo relays

Switch



1a (Nch FET)
TLP240A
TLP3440

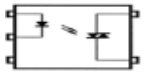


1b (Pch FET)
TLP4227G
TLP4176G

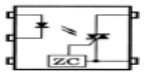
1a1b (Nch+Pch FET)
2b (2 x Pch FET)

Triac output

Switch Pre-driver



Non ZC
TLP267J



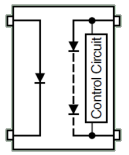
ZC
TLP268J

Switch Pre-driver

Thristor output
TLP748J/548J

Photovoltaic output

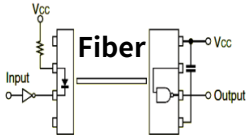
Pre-driver



Simple PV
TLP3905
With discharge circuit
TLP3906

Fiber coupler

Data isolation

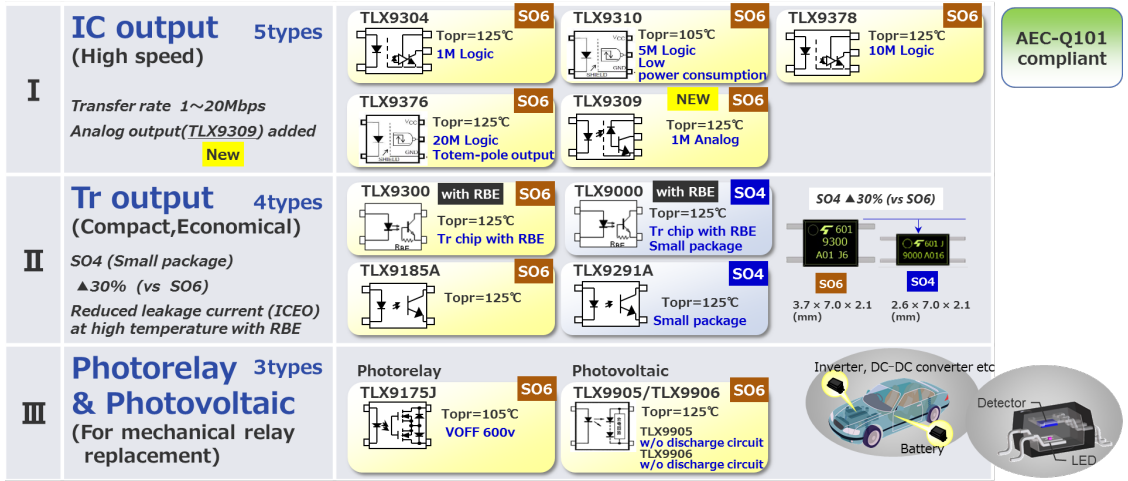


Long Distance
TOTX1350/TORX1350A

Low Current
TOTX1350/TORX1355

Automotive

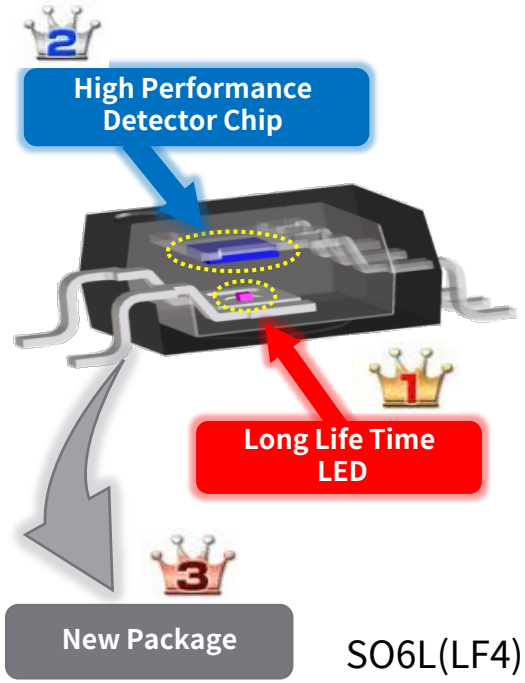
Data isolation
Feedback
Switch
Pre-driver



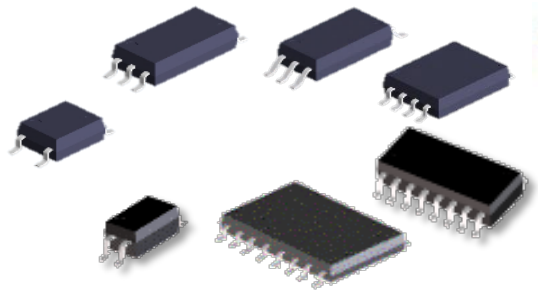
TOSHIBA has been supporting various type of photo coupler

东芝光耦优势

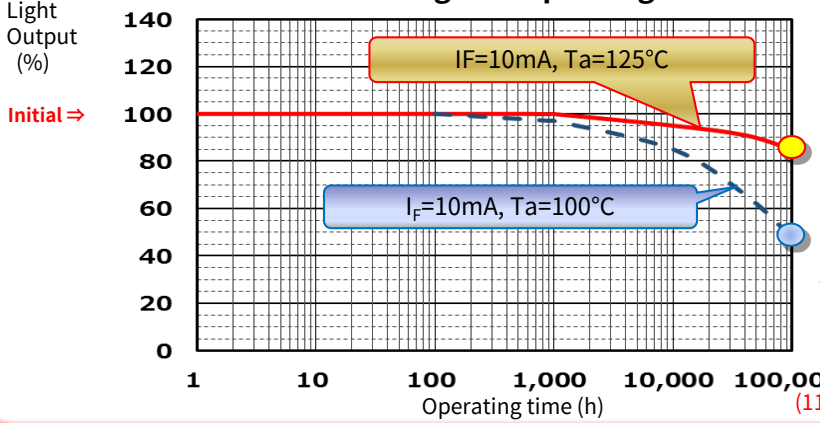
TOSHIBA



SO6L(LF4)



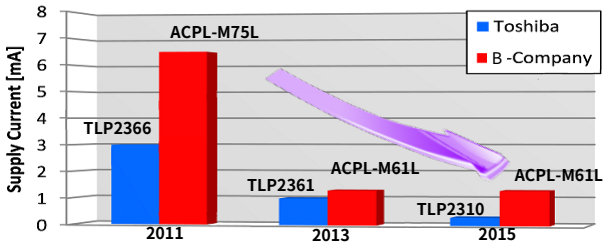
1 Estimated Light Output Degradation



- Long life time
- High Power
- High Temp.

Up to 125°C

2 Low Power consumption

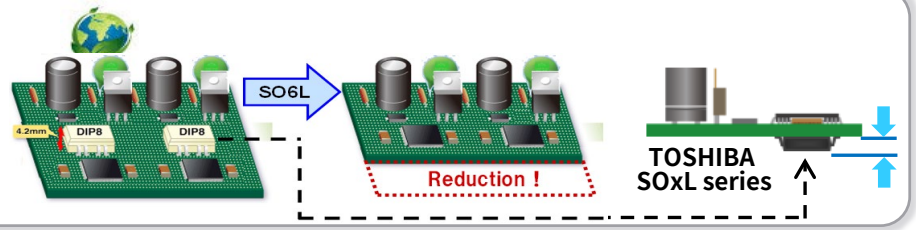


The Lowest current in the industry*

(*) As of Nov. 2018, from a survey by Toshiba

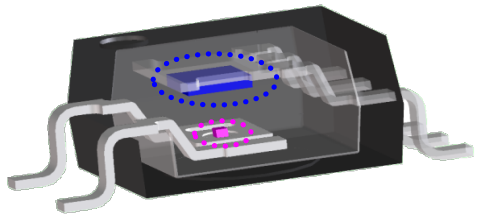
3 Space Saving

Can be mounted on the back side



05-b

IC耦合器–开发产品



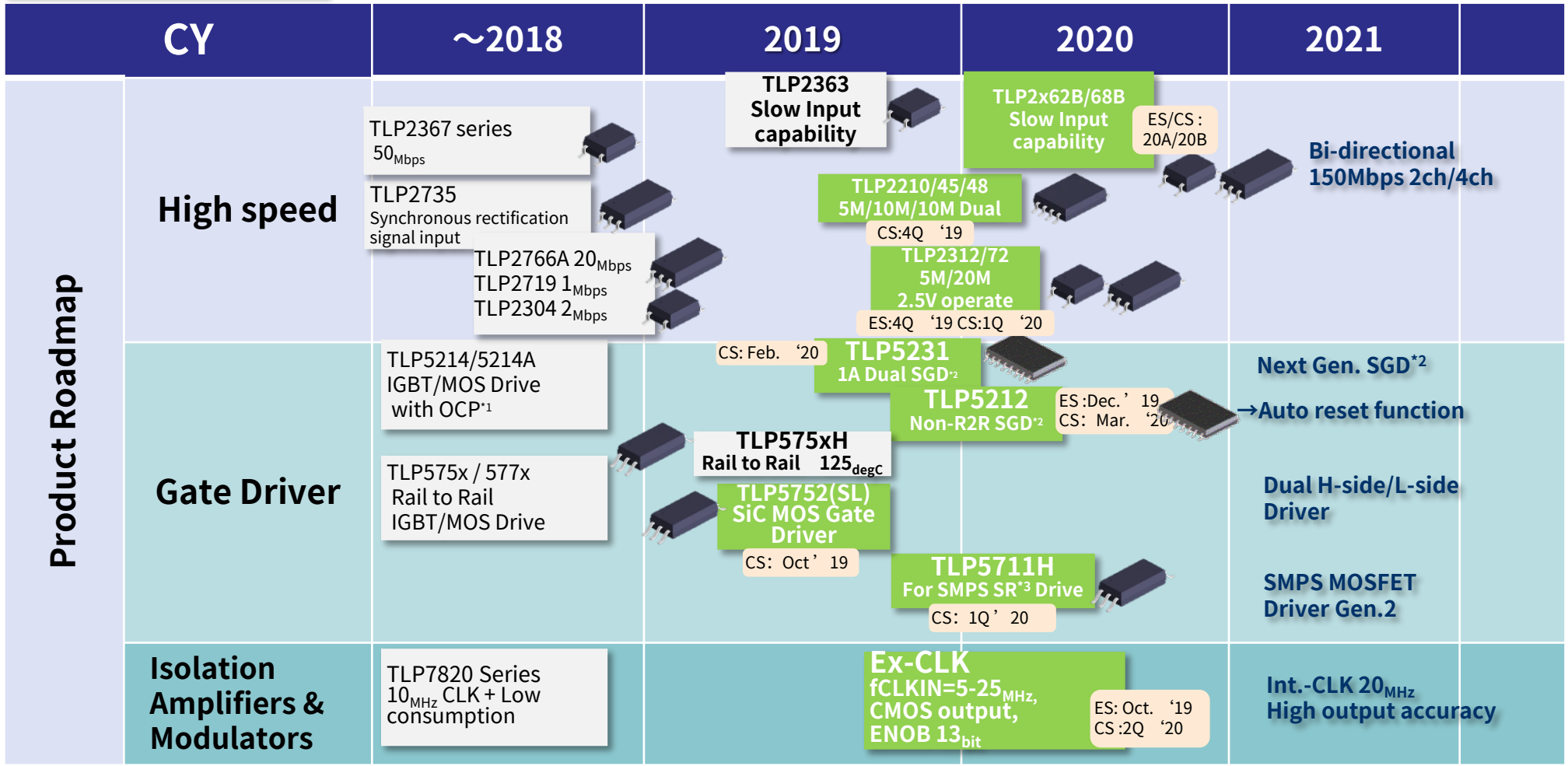
东芝隔离器路线图（IC输出）

Existing products

Under development

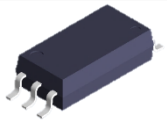
Under concept discussion

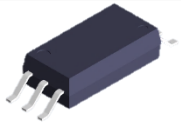
*1 OCP： Over Current Protection
*2 SGD : Smart Gate Driver
*3 SR : synchronized rectifier



As of Sep. 2019. It is subject to change due to changes in market conditions and changes in our production and development environment

TLP5751H(LF4) ／ 5752H(LF4) ／5754H(LF4)　Topr ~125 ℃


SO6L
(planning)


SO6L(LF4)
in MP

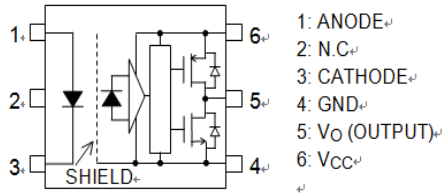
Feature

- **Rail to Rail output**
- High speed 150ns(max.)
- Low skew ±80ns
- Supply current 3mA(max.)
- Threshold current 4mA(max.)
- Operating temp. T_{opr}:-40~**125**˚C
- Direct replacement of ACPL-P340 series and ACPL-W340 series※

Schedule
ES: OK
CS: Oct. '19

	TOSHIBA TLP5754H	Company B ACPL-P341/W341	TOSHIBA TLP700A	TOSHIBA TLP352
Package	(SO6L:planning) SO6L(LF4)	Stretched SO-6	SDIP6	DIP8
Package height	**2.3mm**	3.6mm	4.25mm	4.25mm
V_{OH}	**V_{CC}-0.3V**	V_{CC}-0.3V	11V@V_{CC}15V	11V@V_{CC}15V
V_{OL}	**0.2V**	0.2V	-12.5V@Vcc-15V	-12.5V@Vcc-15V
I_{OP}	**4.0A**	3.0A	2.5A	2.5A
T_{opr}	**-40 to 125˚C**	-40 to 105˚C	-40 to 105˚C	-40 to 125˚C
t_{pHL}/t_{pLH}	**150 ns**	200 ns	200 ns	200 ns
t_{psk}	**±80ns**	±100ns	±80ns	±80ns
V_{CC}	**15 ~ 30V**	15 ~ 30V	15 ~ 30V	15 ~ 30V
BV_s	**5000 V_{rms}**	5000 V_{rms}	5000 V_{rms}	3750 V_{rms}

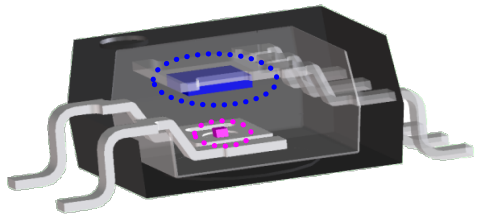
TLP575xH(LF4)
Internal circuit



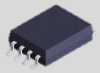
※ Please confirm your PCB design for replacement

05-c

IC耦合器–当前产品信息



IGBT／MOSFET栅极驱动耦合器产品线

Creepage & clearance		5mm	8mm	8mm	8mm	7 or 8mm	7 or 8mm
Isolation voltage		3750 Vrms	5000 Vrms	5000 Vrms	5000 Vrms	5000 Vrms	3750 Vrms
Peak output current	Propagation Delay time	*SO6* 	*SO6L*  SO6L SO6L(LF4)	*SO8L* 	*SO16L* 	*SDIP6* 	*DIP8* 
6.0 A	500 ns						TLP358H (H)
4.0 A	150 ns		TLP5754/(LF4) (R) TLP5754H(LF4) (R) (H) TLP5774/(LF4) (R) (L) 10		TLP5214 (R) (OC) (AMC) TLP5214A (R) (OC) (AMC) TLP5212 (OC) (AMC) TLP5231 (R) (OC)		
2.5 A	~120 ns		TLP5752(SL)/(LF4) (R) ← For SiC-MOSFET drive				
	~150 ns		TLP5752/(LF4) (R) TLP5752H(LF4) (R) (H) TLP5772/(LF4) (R) (L) 10				
	~200 ns	TLP152 10	TLP5702/(LF4)	TLP5832		TLP700A	TLP352 (H)
	500 ns					TLP700H	TLP250H (H) TLP350H (H)
1~2 A	~150 ns		TLP5751/(LF4) (R) TLP5751H(LF4) (R) (H) TLP5771/(LF4) (R) (L) 10				
	~350 ns		TLP5711H (R) (H) 4 ← LV-MOSFET for digital assisted SMPS				
	(~100 ns)		TLP5721H/(LF4) (R) (H) 4				
0.6 A	~200 ns	TLP155E 10				TLP705A 10	
	500 ns	TLP151A 10	TLP5701/(LF4) 10			TLP701A 10	TLP351A 10
	700 ns					TLP701H 10 (H)	TLP351H 10 (H)

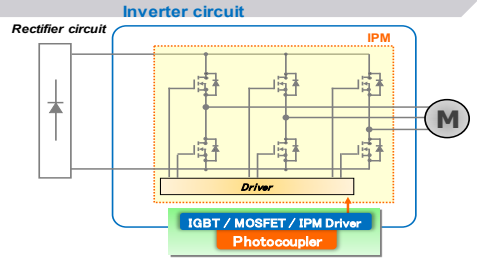
Recommend

(R) Full swing output (rail to rail)
(H) Operation temperature: 125 °C (max)
10 Operation voltage: 10 V (min)
(L) Low LED current: IFLH=2mA (max)
4 Operation voltage: 4 V (min)
OC Over voltage detection (VDESAT)
AMC Active Miller clamp

New
Under development

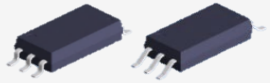
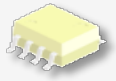
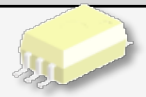
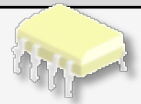
IPM驱动耦合器产品线

IPM : Intelligent Power Module



Blue frame : Recommended Product
Red letter : New Product

Recommended package

Creepage / Clearance			5 mm	8 mm	4 mm	7 or 8 mm	7 or 8 mm
Isolation Voltage			3750Vrms	5000Vrms	3750 Vrms	5000Vrms	5000Vrms
Data rate	Output type	Logic					
			SO6	SO6L/(LF4)	SO8	SDIP6	DIP8
10 Mbps	Totem-pole	BUF	**TLP2345**	**TLP2745** **TLP2735**			
		INV	**TLP2348**	**TLP2748**			
5 Mbps	Totem-pole	BUF	**TLP2355**		TLP2405	TLP715	TLP2955
		INV	**TLP2358**		TLP2408	TLP718	TLP2958
2Mbps	Open-Collector	INV	**TLP104**	**TLP2704**	TLP2404	TLP714	TLP754
1Mbps		INV	TLP109(IGM)	**TLP2719**		TLP719	TLP759(IGM)

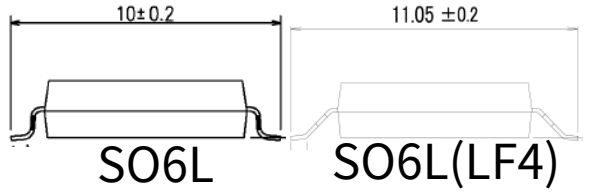
T_{opr}=110 ˚C(Max)　　T_{opr}=125 ˚C(Max)

TLP2719/(LF4)

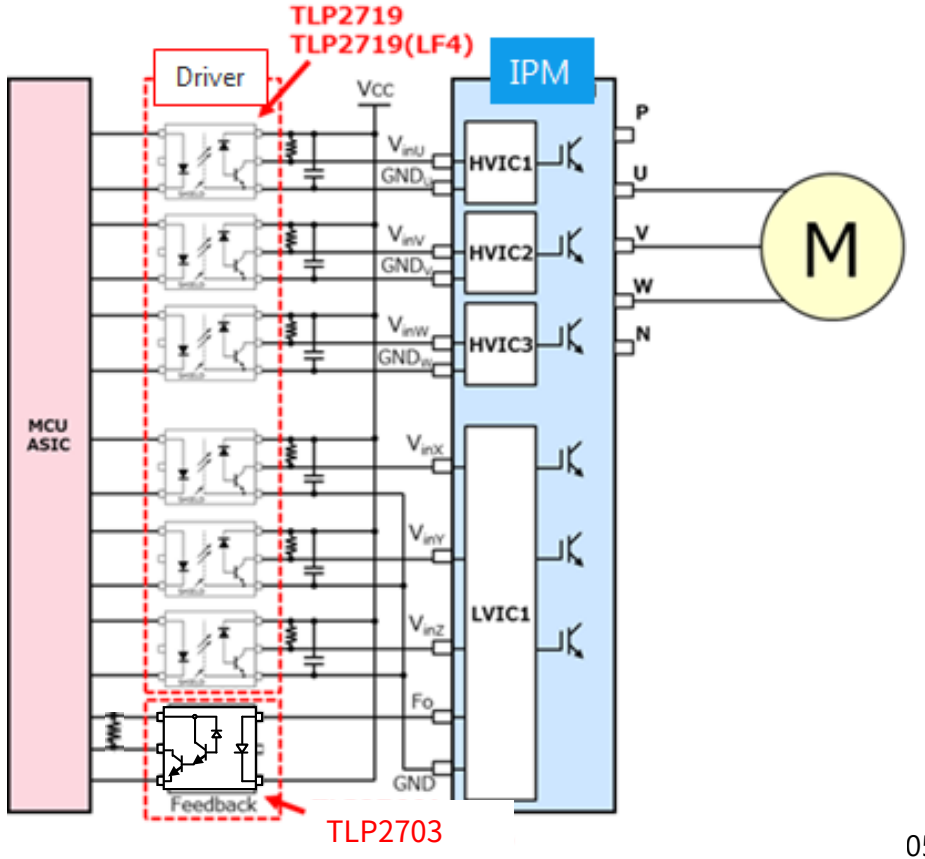
Toshiba is expanding new SO6L & SO6L(LF4) IC output photocouplers.

TLP2719/2719(LF4): 1 Mbps, open-collector output

-Function and footprint compatible with conventional SDIP6 / SDIP6(F type)
-Function and footprint compatible with company B’ s SSO-6



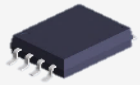
	TLP2719/TLP2719(LF4)	TLP719/TLP719F
Package	SO6L/(LF4)	SDIP6/ SDIP6(Type F)
Output	Open collector	
Prop. delay	800 ns (@Topr = 25 °C)	
IO/IF (Ta=25°C) IO/IF (Ta=-40~100°C)	20%min. 15%min. , 55%max.	20%min. -
tpHL / LH (Ta=25°C) tpHL / LH (Ta=-40~100°C)	0.8µs max. / 0.8µs max. 0.85µs max. / 1.9µs max.	0.8µs max. / 0.8µs max. -
CMTI (min)	±10 kV/µs	
Topr	-40 to 100 °C	
BVs (min)	5 kVrms	
Replacement	ACPL-P454 , ACPL-W454	



~50Mbps高速耦合器产品线

Red: New Product
*: Under development

Vcc 3.3V/ 5V
Vcc 9 to 15V

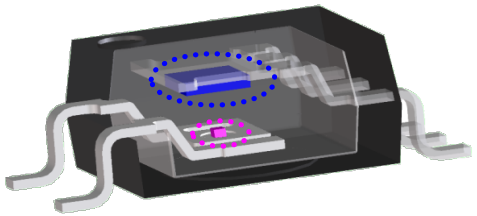
Creepage & clearance		5mm	8mm	8mm	4mm		7or8 mm	7or8 mm
Isolation Voltage		3750Vrms	5000Vrms	5000Vrms	3750Vrms	2500Vrms	5000Vrms	5000Vrms
Data rate (typ.)	Output type							
		SO6	SO6L	SO8L-2ch	SO8-1ch	SO8-2ch	SDIP6	DIP8-1ch
~50 M	Totem-pole	TLP2367	TLP2767					
~20 M	Open-Collector	TLP2368/B*	TLP2768A/B*		TLP2468	TLP2168	TLP2768	
	Totem-pole	TLP2366 TLP2370 B L LP TLP2372* B L LP LV	TLP2766A TLP2770 B L LP TLP2775/8*	TLP2270 B L LP	TLP2466	TLP2160	TLP2766	
~15M	Totem-pole	TLP2361 L LP	TLP2761 L LP	TLP2261 L LP		TLP2161 L	TLP716	
~10M	Open-Collector	TLP2362/B* TLP2363* B L	TLP2762B*					TLP2962 TLPN137
	Totem-pole	TLP2345 B L TLP2348 L	TLP2745 B L TLP2735 B TLP2748 L	TLP2245* B L TLP2248* L				
	±Input	TLP2391 B L						
~5 M	Totem-pole	TLP2355 B L TLP2358 L TLP2310 B L LP TLP2312* B L LP LV	TLP2710 B L LP	TLP2210* B L LP	TLP2405 B L TLP2408 L	TLP2105 B L TLP2108 L TLP2110 B L LP	TLP715 B TLP718	TLP2955 B L TLP2958 L
	±Input	TLP2395 B TLP2398						
~2M	Open-Collector	TLP104 TLP2304	TLP2704		TLP2404		TLP714	TLP754
~1 M	Open-Collector	TLP2309	TLP2719		TLP2409		TLP719	TLP759
~100 k	Open-Collector	TLP2303	TLP2703		TLP2403			
~20 k	Open-Collector	TLP2301	TLP2701					

B Buffer logic output
LV Low Vcc (Vcc 2.5 V)
L Low IF (IFT ⩽ 1.6 mA)
LP Low power (ICC ⩽ 1 mA)

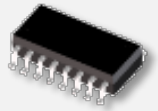
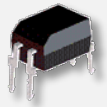
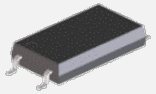
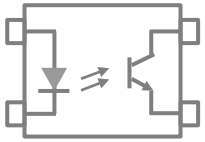
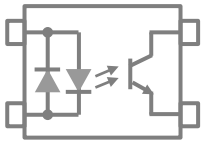
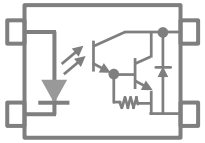
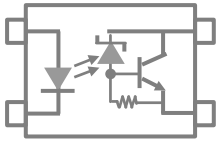
Recommended package

05-d

Tr.耦合器／Triac耦合器



Tr.耦合器产品线

Creepage / Clearance		5 mm	5 mm	5 mm	7 or 8 mm	8 mm
Isolation Voltage		3750Vrms	2500/3750Vrms	3750Vrms	5000Vrms	5000Vrms
Feature \ Package		SO4 	SO16 	4pinSO6 	DIP4 	4pin SO6L 
	DC input	TLP291(SE	TLP291-4	TLP185(SE	TLP785	TLP385
	Low input	TLP293	TLP293-4	TLP183		TLP383
	350V V_{CEO}			TLP188		TLP388
	AC input	TLP290(SE	TLP290-4	TLP184(SE	TLP620M	
	Low input	TLP292	TLP292-4	TLP182		
	Darlington				TLP627M	
	300V V_{CEO}			TLP187	TLP628M	TLP387
	High speed Low input			TLP2301		TLP2701

Using Long Life Time LED

New

*Under development


TOSHIBA